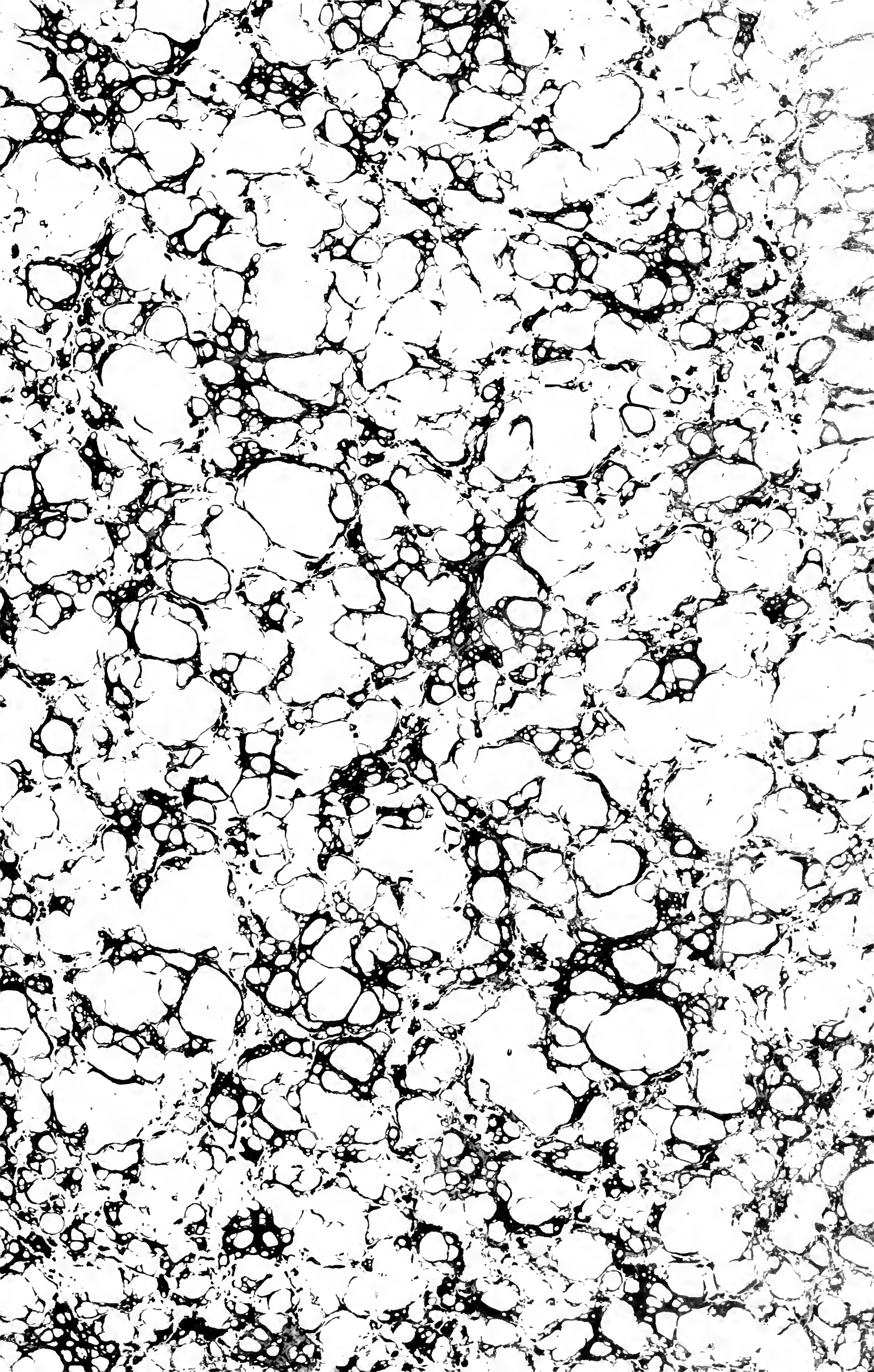

THE

CANADIAN

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AND PROCEEDINGS OF THE

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THE

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NATURALIST AND GEOLOGIST.

VOL. IV. FEBRUARY, 1859. No. 1.

ARTICLE I.—*Remarks on the Geographical Distribution of the Cruciferæ throughout the British Possessions in North America.* By GEORGE BARNSTON, Esq.

(Presented to the Montreal Natural History Society.)

In bringing CRUCIFERÆ forward immediately after FUMARIACEÆ, Torrey, with his usual acumen, has followed the surest indications of relationship. In these two orders the petals and stamens are equal in number, and the superior ovary is formed nearly on the same plan with Parietal Placentæ. In both the sepals are deciduous, and those of Fumariacæ we might almost look upon as four, but united into two. The differences which do exist are not so great as to neutralize the above resemblances in characters so essential to the formation of a natural system. That profound observer Jussieu, also, at an earlier date, did not fail to allow their due weight to these decided marks of propinquity.

Of the species of CRUCIFERÆ to be found in North America, Torrey and Gray describe 113. Of these, there are probably ten that have been introduced, and perhaps nearly as many are common or indigenous to both North America and Europe. The nine or more tribes into which these cruciferæ are divided, derive their characters from the length or shortness of the silique, its dehiscence or indehiscence, the arrangement of the seeds with regard to the

placentæ, their margination, and the position of the cotyledon within the seed. The greater portion of these nine tribes have their species generally diffused, some on the western side of the Rocky Mountains, others on the eastern plateau, and the Atlantic board. The tribe Isatideæ is an exception, however, as it appears only in the far west, where six or seven species of *Thysanocarpi* occur.

Commencing with the ARABIDEÆ, the first tribe of the great siliquose division, we have three species of *Cheiranthus* in North America. The *C. capitatus* in California and Oregon, passing into British territory from Puget Sound, the *C. Pallasii* on the North West coast, and the *C. Hesperidoides*, in Pensylvania, Kentucky, Illinois and Arkansas. No locality in the British territories eastward of the Mountain, appears to be quoted by any author for American Wallflowers; and certainly I have not heard of them native in Canada. The fragrant and most grateful, the *Cheiranthus cheiri*, is only to be found in our gardens.

The *Nasturtiums* (Water-cresses) are well sprinkled over the country south of Canada, but more rarely elsewhere. We possess the *N. palustre*, however, in all quarters, wherever the ground is suitable for it, throughout the length and breadth of the land. The *N. natans*, a scarcer plant, is to be found in Canada and the United States, along the borders of small lakes, and may be distinguished by its immersed leaves being many-parted with capillary segments. The other Nasturtiums are distributed to the number of five in the United States, and of four in the Oregon and on the north west coast.

Barbarea præcox attains to a high latitude, say 68°, and we have it also along the banks of rivers in Canada. The *Barbarea vulgaris*, common in the Northern States, is also found in Oregon and on the north-west coast, running north to Sitka, within the Russian territories. There may be difference of opinion, whether this be an introduced plant or not, according to the quarter where it may be found. Occurring in settled districts in the States, one might pronounce it introduced, while in new or wilder situations another would at once say it was indigenous. It is the Yellow Rocket and Winter Cress of the English; the Cresse de Terre of the French; and Hierba de Santa Barbara of the Spanish.

Passing over the genus *Streptanthus*, of which three species occur in the United States, three in the rocky mountains, and six in California and Oregon, we arrive at the *Turritis* of Dillenius.

Of this genus the species most frequently seen is the *T. glabra*, common enough on the shores of Lake Superior and the banks of the streams running into Hudson's Bay; it extends northward as far as lat. 64°, and in the more northern latitudes is accompanied by the *T. patula*, and *T. retrofracta*, which are distinguished principally by their spreading and retrofract pods. Within the arctic circle the *T. mollis* and *T. diffusa* are joined to them, when the *T. retrofracta* drops off. The *T. patula*, although not reported as higher than 68° on the continent, has nevertheless a variety in Greenland, from which country Sir W. J. Hooker has received it. The *Turritis macrocarpa* and *T. striata* are western plants; the *T. brachycarpa* is confined to the Michigan territory.

The genus *Arabis* has 15 species now discovered in North America, of which five are natives of this province, the *A. petræa*, *hirsuta*, *lyrata*, *lævigata*, and *Canadensis*. The *A. hirsuta*, frequent near the coast of Hudson's Bay, extends to the Oregon, and along the shores of the Pacific as far as Sitka. The *A. petræa* is also marked by Chamisso as a plant of Unalashka. On the north shores of the St. Lawrence below Quebec, the *A. lævigata* is common, and is met with here and there throughout Canada. The two other Canadian species, the *A. lyrata* and *Canadensis*, like the last, travel southwards, and are seen scattered over the States as far as Virginia, Georgia, and the Arkansas. Two species, which appear to be confined to Labrador, the *A. Alpina* and *A. striata*, are amongst the cruciferæ of Europe. Of this rather extensive genus there are still 7 or 8 species to be found in North America, but to the southward of the boundary line. Four of these are the discovery of the indefatigable Nuttall amongst the Rocky Mountains and towards the Oregon.

The bitter cresses, or *Cardamines*, not so numerous in species as the last genus, and more seldom met with in the north than the genera, Turritis and Arabis have the leaves generally pinnately divided, which is a form little observed in the other two. *Cardamine rotundifolia*, and *C. bellidifolia*, have undivided leaves, and are extensively distributed, each in its chosen habitat. The former best known in the eastern and northern states, was also procured by Drummond in the Rocky Mountain defiles, from lat. 52° to 57°, which for one season, the summer of 1856, he took as the range for his botanical researches. Lake Superior and Hudson's Bay have also been quoted as affording this plant. The *C. bellidifolia* is a native of Arctic America, but, like some other plants of

that region, has its alpine residences in more southern latitudes. The summits of the Rocky Mountains in lat. 52°, and what is more remarkable and interesting, the White Mountains of New Hampshire, claim the *C. bellidifolia* as a native. *Sub Jove frigido!* we may exclaim, as we meet this errant stranger in its airy quarters, and imagine while we pluck it that we inhale the atmosphere of the arctic zone. A still more extraordinary place allotted for this plant is California, as testified by Douglas, whose observations were always so clear and so well authenticated, that we are scarcely at liberty to doubt them. The pinnately leaved *Cardamineæ* amount to seven, according to Torrey and Gray, three of which are Arctic plants. The *C. pratensis* of Linnæus is on the islands of the Arctic Ocean as well as in Behrings Straits, so that we may conclude with a considerable degree of certainty that it extends alongst the whole northern coast of this continent. Being a native also of Hudson's Bay, Canada, and the western part of the State of New York, it would appear that it accommodates itself to a breadth of climate equivalent to at least 30 degrees of latitude. The *C. hirsuta*, running less to the northward, (as far as has yet been observed,) is nevertheless found on the coasts bordering on the Arctic Sea, and on the north-west coast in high latitudes, having a distribution eastward and westward equal to the breadth of the continent in lat. 45°. The *C. Virginica* of U. States' botanists is a variation of the Cardamine we have just had under consideration. The *Cardamine digitata* is confined entirely to the north, and passes over Behring's Straits to form one of the Siberian Flora. Other three species are the *C. angulata*, and *C. oligosperma*, from the Oregon, and *C. Ludoviciana*, from Georgia, Kentucky, and the Arkansas, but they are foreign to the British possessions. *Cardamine purpurea* is a Siberian plant, and although by the celebrated voyage and discoveries of Captain, now Admiral Beechey, we know that it passes over to Kotzebue's Sound, yet it must still only be considered as foreign, as it has not yet been heard of beyond the Russian territories.

The *Dentaria*, near *Cardamine*, but having the roots toothed or tubercled, is a southern genus. *D. laciniata*, and *D. diphylla*, enter Canada, but do not, as far as I have observed, advance farther northward. The *D. tenella*, and *D. macro-carpa*, belong to the Oregon, and it is very probable may yet be discovered passing the boundary line of 49°, and so enter into our list of New Caledonia or Fraser River plants. Should Palliser's party cross

the Rocky Mountains, much information no doubt will be obtained regarding plants, and other subjects of natural history, from the able and zealous naturalists composing that scientific party. The Thompson's and Frazer's River countries display as fine a field for the enterprise of scientific and speculative minds as is to be found in North America.

Following the *Dentaria*, we have the genus *Parrya*, a name given by R. Brown to an Arctic plant or two, to commemorate the distinguished officer, who was amongst the foremost of the discoverers in the expeditions which were set on foot during the present century, to ascertain the reality of a North West passage. As it is a northern plant, I may state that in it the pods are broader than in the genera hitherto mentioned, the valves are veiny, the seeds broadly margined, and the funiculi more or less adherent to the septum. On the Arctic coast, to the eastward of Mackenzie River, we have one species, the *Parrya arctica* of Brown; and to the westward of the same river, and on the north-west coast, the *Parrya macrocarpa*. By the late Sir John Franklin and his companion, now Sir George Back, the *P. macrocarpa* was brought home on their second voyage to and from the Arctic coast; but it must have been known before this to the Russians, Linnæus having described a variety of it under the name, *Arabis caule-nudo.*

The two genera with which Torrey closes the *Arabideæ* of North America are the *Phenicaulis* and *Leavenworthia;* but I pass them over, as the former occurs only to the westward of the Rocky Mountains, at the Forks of Lewis and Clark, on the high hills of the Wallawalla, and the other is confined to the Central and Southern States.

We are introduced to the tribe *Sisymbreæ* in the genus *Hesperis*, of which there are two of North America. The *Hesperis minima* is the same plant as the *H. pygmæa* of Hooker, and probably does not differ from the *Cherianthus Pallasii* of Pursh. It scarcely passes to the southward of the Arctic circle, but stretches from Behring's Straits eastward as far as Great Bear's Lake, where it was found by Sir John Richardson. The *H. Menziesii* is recognized as coming only from California.

The genus *Sisymbrium*, like that of *Arabis*, dispenses its species over Arctic as well as Sub-arctic America, and that too in not very unequal order. The *Sisymbrium officinale* is supposed to have been introduced from Europe into Canada and the

United States, but the *S. Sophia*, which appears in various localities in Lower Canada, may be a native; a point, however, not easy to be determined. Common to British America and the United States is the very generally diffused *Sisymbrium canescens*, which is also found on the Rocky Mountains, and westward to Oregon and California. This soft-looking, frequently hoary plant, is very hardy, bearing the rigours of the north as well as the heats of Georgia and Arkansas. The *S. Sophioides* of Fischer, found in high latitudes, extends from Hudson's Bay to the Arctic coast, stretching westward round the continent to the Pacific. It is remarkable amongst its kind by the flowers and pods being in umbelliform corymbs. The *S. junceum* is from dry stony grounds in the Oregon. Six or seven other species, the discoveries of Nuttall, are found on the hills of the great dividing ridge, south of 49°; but it is very probable that some if not all of these will be met with by Monsieur Bourgeau, the French botanist attached to Palliser's exploring party, which has been busy last season on the Bow River, and near the boundary line, where it crosses the back-bone of America. In that quarter, hitherto so dangerous, and therefore seldom or never approached by the foot of civilized man, there is a portion of both prairie and mountain yet unsearched, its geology and its botany only deducible from what is known of districts far removed from it. We may therefore anticipate a most interesting description of novelties, in the natural history of the region in question, when the surveying and exploring expeditions bring the fruits of their labors before the public. In concluding my remarks on the present genus, I may observe that the *S. humile*, a Siberian species, is also a production of the Rocky Mountains, but in the higher latitudes, from 52° to 68°. The *Sisymbrium Thalianum*, the *Arabis Thaliana* of Linnæus, has been introduced from Europe.

Passing the *Tropidocarpa* of Hooker, natives of California, we come upon the genus *Erysimum*, which contains some handsome species, shewing themselves on the plains, and on the dry grassy spots throughout the north. The *E. cheiranthoides*, known in Europe, is also gathered in Canada and the United States, and in the prairie country. We find it west of the Rocky Mountains in lat. 47°, as far as the Pacific; and Hooker gives it a place on the banks of the McKenzie, up to 67°. The *E. lanceolatum*, a handsome little plant, appears in the flora of Canada, and, proceeding northwards, reaches the Arctic Sea.

Torrey and Gray are silent as to its presence on the Pacific, although from Hooker's work we might conclude that it existed there. The *E. asperum*, a closely allied species, flourishes in the plains eastward and westward of the mountain ranges, attaining the latitude of 65° on the McKenzie. Strictly speaking, the interior of the continent is its peculiar ground, as it does not in any quarter appear to approach the sea-coast within a considerable number of degrees. Nuttall has five others of this genus, none of which have yet been noted as on British territory. One is from Arkansas and Texas, two are from the elevated plains of the Rocky Mountains, one from the banks of the Willamet, and the fifth from the neighbourhood of Monterey, Upper California.

The second great division of *Cruciferæ* is like that of the SILIQUOSÆ, very extensively distributed over all the temperate climes of the northern hemisphere, and British America has its portion of them. In the genus *Vesicaria*, the *V. arctica* extends from the island of Anticosti to the Arctic Regions, where it prevails most. The borders of the eastern prairies are probably the limit of its range westward, in the lat. of 52°. The *V. didymocarpa* is a very singular species, conspicuous by its strong corymb of flowers, and when in fruit remarkable for its evidently bilobed didymous silicle, which is orbicular or inflated. On the Rocky Mountains, from lat. 52° to 57°, and in all probability southwards to the sources of the Platte, it seeks the deep sand-banks and sand-beds, wherever its long fusiform roots may find easy lodgment.

Of all the genera of the Cruciferous order, *Draba* has in North America the greatest number of species. Thirty belong to this continent, and of those the greater part are Arctic and sub-Arctic plants. Confined to high northern latitudes, and scattered over the islands and shores of the Arctic Seas, we have the *D. algida*, *alpina*, *pauciflora*, *micropetala*, *oblongata*, *corymbosa*, *lapponica*, and *stellata*. In the extreme north is also found the *D. glacialis;* but this has likewise an Alpine residence southwardly, on the summits of the Rocky Mountains, to which the others apparently do not stray. The *Draba lævigata* has been seen as yet only at the extremity of North West America. Common to the sub-Arctic as well as Arctic regions are other Drabas more likely to be fallen in with by the Canadian botanist. The *D. muricella* exists in the north, and in Labrador. The *D. incana*, stretching along the coast of the Frozen Sea from Unalaschka to Labrador, can be

gathered plentifully on the north shores of the St. Lawrence. The *D. hirta*, is common on the rocky islands of Lake Superior; and the *D. glabella*, *lutea*, and *nemoralis*, approach the confines of Canada West. Hooker gives the island of Montreal as a habitat of the *Draba muralis* of Linnæus. The *Draba oligosperma*, a native of the banks of McKenzie's River, appears to have been collected by Nuttall on the summit of lofty hills near the sources of the Platte. The Rocky Mountains afford near their heights some Drabas peculiar to the range; the *D. densifolia* at the sources of Lewis's River, the *D. rupestris levipes*, *crassifolia* and *aurea*, on the same ridges, as far north as lat. 57°. The strictly southern species are fewer in number. *D. arabisans* is found near Lake Champlain, and in the States of New York and Michigan, crossing to the north shore of Lake Superior. Five or six others are dispersed only over the Central and Western States; but the *D. verna*, with bipartite petals, which may be reckoned among these, sometimes may be seen decking the hill-sides and fields of our province.

The fifth tribe of Cruciferæ, the *Alyssineæ*, commencing with *Vesicaria*, continued in *Draba*, will end with *Cochlearia*, a genus pre-eminently Polar, as encircling to a great extent the Great Polar Basin, representing the great flowering classes almost at the very limits of vegetation, and bearing the standard of Flora nearly to the axle of our sphere. Three *Cochlearia* belong to Russian America, and four to our Arctic coast. These latter are the *C. Anglica*, *fenestralis*, *officinalis*, and *Danica*. *C. trydactylites* is said to occur in Labrador, and *C. Greenlandica* pertains to Greenland. Diffused laterally like a belt or girdle, this genus, assisted by other plants of a similar constitution, and the Mosses and Lichens, helps to produce an identity of vegetable growth and covering to the earth in the highest northern latitudes, on the European, Asiatic, and American shores.

The genus *Camelina*, from which the sixth tribe of Cruciferæ, the *Camelineæ*, takes name, has but one species native of North America, the *C. barbareæfolia*, which has been found only on the Russian territory on the north-west coast. The *C. sativa* must be an introduced plant, and is probably working its way westwards and northwards with the progress of civilization.

Braya, with the four following genera, has been placed by Torrey, with some degree of doubt, in the tribe *Camelineæ*. The *Braya alpina* is obtained on the Rocky Mountains, from

latitude 52° to 57°; and the *B. glabella* and *pilosa* are the discoveries of Sir John Richardson, on the shores of the Arctic Sea, the latter having been met with only at the outlet of McKenzie River.

Platypetalum purpurascens has a habitat extending from McKenzie River to Spitzbergen, and the *P. dubium* is a species of Melville Island.

Two *Eutremæ*, the *E. Edwardsii*, upon which R. Brown founded the genus, and the *E. arenicola*, are both Arctic plants. The former was discovered first on Parry's voyage to Melville Island, and was afterwards collected, along with the second, on the Arctic coast, on each side of the McKenzie, by the travellers Franklin and Richardson.

A single species of the genus *Platyspermum*, the *P. scapigerum* was the discovery of David Douglas, at the great Falls of the Oregon or Columbia River.

The *Subularia aquatica* of Linnæus has been procured from the borders of ponds in Maine by Nuttall.

Two tribes having the silicle compressed, contrary to the narrow septum, will now complete what has to be said regarding the SILUCULOSÆ and their distribution. These are the *Thlaspidineæ* and *Lepedineæ*.

The *Thlaspi arvense* of Linnæus, as well as the *Thlaspi alpestre*, are commonly met with in old waste grounds in Canada. Both I believe to have been introduced, for neither of them occur to my knowledge in the newly-settled or the uncultivated and wilder parts of the country. The *Thlaspi alliaceum* is rare. The indigenous species *T. montanum* is found from Canada to the Arctic zone; and the *T. cochleariforma*, closely resembling it, occupies a western position, about the head waters of the Oregon. The *T. tuberosum*, remarkable for its tuberiferous roots, does not appear to have been met with in Canada or the North. It was discovered by Nuttall in Western Pennsylvania.

Hutchinsia, another genus of this tribe *Thlaspidiniæ*, has a species, the *H. calycina*, from the Rocky Mountains, in lat. 52° to 57°; a variety of it is noted as native in Kotzebue's Sound.

The *Lepidium ruderale* occurs frequently throughout the British Possessions from Hudson's Bay to the Pacific Ocean, preferring waste places like the Thlaspi. The *L. campestre*, common about fields and gardens, is a weed introduced from England. Species are met with passing the Rocky Mountains into the

Oregon Territory, such as the *L. integrifolium* and *L. montanum.* The *Lepidium Menziesii*, first known on the north-west coast, was also gathered by Drummond in the Rocky Mountains, afterwards by Nuttall on the same ranges farther south. We can merely name the Californian species, the *L. oxycarpum* and *L. latipes*, discovered by Douglas; the *L. Californicum, lasiocarpum*, and *nitidum*, by Nuttall.

The *Capsella bursa-pastoris*, or Shepherd's Purse of the old countryman, is well diffused over the whole country to the roots of the Rocky Mountains westward, and to Great Bear's Lake northwards. About this, our well-known old friend, there is never any mistake. The declared plague of the pasture, and detested by the industrious gardener, the *bursa-pastoris* nevertheless gladdens our eye with its homely and home-like look, reminding us of early days and all their associations, the country road, the cotter's kale-yard, and other long-forgotten scenes.

The third division of our order, the *Nucamentosæ*, containing the ninth tribe, the *Isatideæ* of Decandolle, furnishes us with but one genus on this continent, the *I. thysanocarpus* of Hooker, of which all the species lie west of the Rocky Mountains. The *I. curvipes*, upon which the genus was founded, was discovered by Douglas at the Great Falls of the Columbia; and the *I. oblongefolius* was first discovered by Nuttall as being native of the same country, but much lower down the river, at the junction of the Willamet. Four others are Californian, the *I. elegans* and *pulchellus* of Fischer and Meyer, and the *I. crenatus* and *laciniatus* of Nuttall.

In the fourth division *Lomentaceæ* is the tenth tribe, *Cakilineæ*, in which we have the genus *Cakile.* The single species, *C. Americana*, is a strange-looking plant, known in English as the Sea Rocket. The pods are constricted, and have transverse separations, forming one celled, one seeded joints. It is not apparently a common plant, but occurs near the sea, and on the shores of the great lakes of Canada. I have seen it on sand along the north bank of the great St. Lawrence River, from the Gulf up as far as the Saguenay. Its fleshy leaves no doubt enable the Cakile, although on a smaller scale than the purely succulent orders, such as the Cacti, &c., to assimilate much of its sustenance from the air; nature thus, by wise modifications of structure, compensating liberally in one way, for what may be wanting or stinted in another. I have been sometimes surprised at the fresh-

ness of the Cakile in a dry sand, where most other plants of the same order would have withered and perished.

In taking leave of this most useful and interesting order, I may with propriety quote from Sir John Richardson's very able observations at the end of his "Journal of a Boat Voyage," published in 1851. Regarding Polar plants, he says:—"Of the Polar "plants, amounting to 91 species, which inhabit Melville Island, "the shore of Barrow's Straits to Lancaster's Sound, and the "north coast of Greenland, between the 73rd and 75th parallels "of latitude, about $\frac{4}{5}$ths range to Greenland, Lapland, or Northern "Asia. Of the remainder some have been gathered on the shores "of the Arctic Sea from Baffin's Bay to Behring's Straits, and it "is probable if these high latitudes were fully explored, the Flora "of the entire zone would be found to be uniform. Some of the "more local plants will perhaps be ascertained, on further ac- "quaintance, to be mere varieties altered by peculiarities of "climate. That the Flora as well as the Fauna of the high "northern latitudes is nearly alike in the several meridians of "Europe, Asia and America, has long been known; and even "when to some distance south of the Arctic circle, we find that "this law is superior to the intrusion of high mountain chains, "and is but partially infringed upon." Further on he observes: "The families of Polar plants which are most rich in species are "the Cruciferæ, Gramineæ, Saxifrageæ, Caryophylleæ and Com- "positæ. Of these, the Saxifrageæ are most characteristic of "extreme northern vegetation. All of them that inhabit the 74th "parallel in America are found also in Spitzbergen, Lapland or "Siberia; and even the Polar species are twice as numerous as "those which exist in the wide district which 'Gray's Flora of "the Northern States' comprehends; and we may add, that the "plant which Humboldt traced highest in the Andes, was a "Saxifrage. The Caryophylleæ and Cruciferæ, which vie with "the Saxifrageæ in number on the 74th parallel, include many of "the doubtful species above alluded to."

There is no doubt every reason to believe that Sir John's words as to the unlucky multiplication of species through the separation of varieties will some time or other prove true, not only in the plants of the Arctic zone, but also in those further south. More extended acquaintance with both will correct our knowledge in that particular. Able monographs amongst American and European botanists will do this work, so much required.

With regard to Cruciferæ in particular, it appears to me that there exists in the species of this order an aptitude to reconcile themselves to the various peculiarities and changes of climate incident to countries under different meridians. In North America many European Cruciferæ have become naturalized. They frequently usurp a prevalence in our gardens and in cultivated grounds, so as to become weeds, reminding the old countryman at every step of scenes of his youthful home. *Nasturtium officinale*, *Barbarea vulgaris*, *Thlaspe arvense*, *Lepidium campestre*, and most frequent of all, the *Capsella bursa-pastoris*, are naturalized Americans and Canadians; and is not this in perfect accordance with the diffusive character of the order, as noted by botanists in those species which exist in the highest northern latitudes?

In those dismal regions where ice holds almost eternal empire, and where frost is arrested but for a few short weeks of the year, we still may please ourselves with discovering that wise provision is made, as far as possible under the circumstances, for the wants of man. The intense cold of winter and spring requires that the bodily functions of the Esquimaux should be fortified by a diet of pure animal food, and that too of the fattest and most oily description. The composition of the blood is thus preserved in a state fit for supporting the human frame, while the lungs are breathing freely an intensely cold condensed atmosphere. When the summer arrives, and the length of sunshine heats the air, the natives must have their systems surcharged. Nature then may be supposed as stepping in, and supplying from her stores the most cooling, aperient, and anti-scorbutic vegetables for their relief. The Esquimaux at this season, by having recourse to the productions of mother earth, may have his blood purified and his skin cleansed, as well as the inhabitant of the tropics can by the condiments around him have his languid appetite stimulated, and the incipient fever assuaged. In whatever quarter of the globe man may be placed, surely by searching he may find what is best calculated to benefit him. Let him only take the trouble and time to investigate, and turn to advantage what has been so liberally—nay, often so lavishly, we may say—spread out before him, and he will not fail to discover, that an unseen hand has been long since at work to anticipate his wishes, and supply his needs.

Montreal, January, 1859.

ARTICLE II.—*Fish Manures.* By T. STERRY HUNT. Extracted from the Report of the Geological Survey of Canada for 1857.

Before describing the results of some enquiries into the value of these manures, and the practicability of introducing their manufacture into Canada, it may be well to explain briefly certain principles which may serve to guide us in the appreciation of the subject. Modern investigations of the chemistry of vegetation have led to a more or less correct understanding of the laws of vegetable nutrition and the theory of manures, and we are all aware how many natural and artificial matters have been proposed as substitutes for the manure of the stable and farm-yard. Foremost among these ranks the Peruvian guano, composed for the most part of the exuviæ of sea-birds, and employed for centuries by the Peruvians as a powerful stimulant to vegetation. This substance owes its value to the phosphoric acid and ammonia which it is capable of affording to the growing plant; the former element being indispensable to the healthy development of vegetation and entering in large proportion into the mineral matter of the cereals, while ammonia furnishes in a form capable of assimilation, the nitrogen, which with the elements of water and carbonic acid, makes up the organic tissues of plants. Besides these essential principles, plants require sulphuric acid, silica, chlorine, potash, soda, lime, magnesia and oxyd of iron, all of which elements are found in their ashes, and are required for their healthy growth. In a fertile soil all of these ingredients are present, as well as phosphoric acid and ammonia, which last substance is constantly produced by the decay of animal and vegetable matters, and is either at once retained by the soil, which has the power of absorbing a certain portion of it, or is evolved into the air and afterwards dissolved and brought down by the rains to the earth.

Many of the mineral elements of a soil are present in it in an insoluble form, and are only set free by the slow chemical reactions constantly going on under the influence of air and water. Such is the case with the alkalies, potash and soda, and to a certain extent with the phosphates. Now although there is probably no soil which does not yield by analysis quantities of all the mineral elements sufficient for many crops, yet by long and uninterrupted tillage the more soluble combinations of these elements may be all taken up, and the land will then require a certain time

of repose in order that a store of more soluble matters may be formed. Hence the utility of fallows.

In my analysis of the soils of the Richelieu valley, in the Report for 1850, pp. 79-90, I have shown, by comparing the virgin soils with those exhausted by continued crops of wheat during fifty years, that the proportions of phosphoric acid and magnesia, elements which are contained in large quantities in this grain, have been greatly diminished, but the soil still contains as much phosphate as it has lost, and this only requires to be rendered soluble in order to be available to vegetation.

In forests and untilled lands the conditions of a healthy vegetable growth are seldom wanting; the soil affords in sufficient quantity all the chemical elements required, while the leaves and seeds which annually fall and decay, give back to the earth a grea proportion of the elements which it has yielded. In this way the only loss of mineral matter is that which remains stored up in the growing wood or is removed by waters from the soil. Far different is the case in cultivated fields, since in the shape of corn, of fat cattle, and the products of the dairy, we remove from the soil its phosphates, alkalies and nitrogen, and send them to foreign markets. The effect of tillage becomes doubly exhaustive when by artificial means we stimulate vegetation without furnishing all the materials required for the growing plants. Such is the effect of many special manures, which while they supply certain elements, enable the plants to remove the others more rapidly from the soil. A partial exhaustion of the soil results likewise from repeated crops of the same kind; for the elements of which the cereals require the largest quantity are taken in smaller proportions by green crops, and reciprocally, so that by judicious alternations the balance between the different mineral ingredients of the soil is preserved.

One of the great problems in scientific agriculture is to supply to the soil the ammonia and the mineral matters necessary to support an abundant vegetation, and to obtain from various sources these different elements at prices which will permit of their being economically made use of. Nowhere but in the manure of the stable and farm-yard can we find combined all the fertilizing elements required, but several of them may be very cheaply procured. Thus lime and magnesia are abundant in the shape of marl and limestones; soda is readily obtained, together with chlorine, in common salt; while gypsum or plaster of Paris supplies at a low

price both sulphuric acid and lime. Potash when wanting may be supplied to the soil by wood-ashes, but phosphoric acid and ammonia are less easily obtained and command higher prices.

An abundant supply of phosphate of lime is found in bones, which when dried contain from 50·0 to 60·0 p. c. of mineral matter, consisting of phosphate of lime, with a little carbonate, and small portions of salts of magnesia and soda. The remainder is organic matter, which is destroyed when the bones are burned. This phosphate of lime of bones contains 46·0 per cent of phosphoric acid, and the refuse bone-black of the sugar-refiners usually affords about 32·0 per cent. of the acid. The different guanos also contain large amounts of phosphoric acid, and that known as Columbian guano is principally phosphate of lime. Various deposits of mineral phosphate of lime have of late attracted the attention of scientific agriculturists. I may mention in this connection the crystalline phosphate of lime or apatite of our Laurentian limestones, and the phosphatic nodules found in different parts of the Lower Silurian strata of Canada and described in previous Reports.

These mineral phosphates are in such a state of aggregation, that it is necessary to decompose them by sulphuric acid before applying them to the soil. The same process is also very often applied to bones; for this end the phosphate of lime in powder is to be mingled with nearly two-thirds its weight of sulphuric acid, which converts two-thirds of the lime into sulphate, and leaves the remainder combined with the phosphoric acid as a soluble super-phosphate. In this way, the phosphoric acid may be applied to the soil in a much more divided state, and its efficiency is thereby greatly increased. Even in its soluble form however, the phosphoric acid is at once neutralized by the basic oxyds in the soil, and Mr. Paul Thenard has lately shown that ordinary phosphate of lime, when dissolved in carbonic-acid water, is decomposed by digestion with earth, insoluble phosphates of iron and alumina being formed, which are again slowly decomposed by the somewhat soluble silicate of lime present in the soil and transformed into silicates with formation of phosphate of lime. It is probable that alkaline silicates may also play a similar part in the soil. These considerations show that the superior value of soluble phosphate of of lime as a manure, depends solely upon its greater subdivision. A portion of the phosphoric acid in Peruvian guano exists in a soluble condition as phosphate of ammonia.

With regard to the nitrogen in manures, it may exist in the form of ammoniacal salts, or combined in organic matters which evolve ammonia by their slow decay. The ammonia which the latter are capable of thus yielding, is designated as potential or possible ammonia, as distinguished from the ammonia of the ammoniacal salts, which is generally soluble in water, and is at once disengaged when these matters are mingled with potash or quick-lime. Such is the sulphate of ammonia, which is prepared on a large scale from the alkaline liquid condensed in the manufacture of coal-gas. In Peruvian guano a large amount of the nitrogen is present as a salt of ammonia, and the remainder chiefly as uric acid, a substance which readily decomposes, and produces a great deal of ammonia. In fact, this decomposition takes place spontaneously, with so much rapidity, that the best guanos may, it is said, lose more than one-fifth of their nitrogen in the form of ammonia in a few months' time, if exposed to a moist atmosphere.

Other manures, however, contain nitrogen in combinations which undergo decomposition less readily than uric acid. Thus unburned bones yield from six to seven per cent. of ammonia, and dried blood, fifteen or sixteen per cent, while woollen rags and leather yield about as large a quantity. In estimating the value of such matters as manures, the difference in the facility with which they enter into decomposition, must be taken into account. Thus if too large quantities of guano are applied to the soil, a portion of the ammonia may be volatilized and lost, while with leather and wool the decay is so slow, that these materials have but little immediate effect as manures. The nitrogen of blood and flesh is converted into ammonia with so much ease, that it may be considered almost as available for the purpose of a manure as that which is contained in ammoniacal salts.

Attempts have been made to fix the money value of the ammonia and the phosphates in manures, and thus to enable us from the results of analysis, to estimate the value of any fertilizer containing these elements. This was I believe first suggested a few years since, by an eminent agricultural chemist of Saxony, Dr. Stockhardt, and has been adopted by the scientific agriculturists of Great Britain, France and the United States. These values vary of course very much for different countries; but I shall avail myself of the calculations made by Prof. S. W. Johnson of New Haven, Connecticut, which are based on the prices of manures in e United States in 1857. In order to fix the value of phosphoric

acid in its insoluble combinations, he has taken the market prices of Columbian guano, and the refuse bone-ash of the sugar refiners, which contain respectively about 40 and 32 per cent. of phosphoric acid, and from these he deduces as a mean 4½ cents the pound as the value of phosphoric acid when present in the form of phosphate of lime. This would give $1.44 as the value of 100 pounds of bone-ash, and $1.60 for the same amount of the guano, while they are sold for $30 and $35 the ton.

The value of soluble phosphoric acid has been fixed by Dr. Volcker in England, and by Stockhardt in Saxony, at 12½ cents the pound. This evaluation is based upon the market price of the commercial super-phosphates of lime. Mr. Way of the Royal Agricultural Society, however, estimates the value of phosphoric acid in its soluble combinations at only 10½ cents the pound; and Mr. Johnson, although adopting the higher price, regards it as above the true value.

In order to fix the real value of ammonia, Prof. Johnson deducts from the price of Peruvian guano, at $65 the ton, the value of the phosphoric acid which it contains, and thus arrives at 14 cents the pound for the price of the available ammonia present. This kind of guano, however, now commands a price considerably above that which serves for the basis of the above calculation; and both Volcker and Stockhardt fix the value of ammonia at 20 cents the pound. The price of potash as a manure is estimated by Mr. Johnson at 4 cents the pound; but this alkali rarely enters to any considerable extent into any concentrated manures, and may therefore be neglected in estimates of their value.

The use of fish as a manure has long been known; on the shores of Scotland, Cornwall, Brittany, some parts of the United States, and on our own sea-coasts, the offal from fisheries, as well as certain bony fishes of little value for food, are applied to the soil with great benefit. The idea of converting these materials into a portable manure was however I believe first carried into effect in France by Mr. Démolon, who seven or eight years since, erected establishments for this object on the coast of Brittany and in Newfoundland. For the details of this manufacture I am indebted to the *Chimie Industrielle* of Payen. Concarneau, in the department of Finisterre, is a small town whose inhabitants are employed in fishing for sardines, and it is the refuse of this fishery which is employed in the manufacture of manure. The offal is placed in large coppers and heated by steam until

thoroughly cooked, after which it is submitted to pressure, which extracts the water and oil. The pressed mass is then rasped, dried in a current of hot air, and ground to powder. 100 parts of the recent offal yield on an average 22 parts of the powder, besides from 2 to 2½ parts of oil. The manufactory of Concarneau employs six men and ten boys, and is able to work up daily eighteen or twenty tons of fish, and produce from four to five tons of the powdered manure.

This manure contains, according to an average of several analyses, 80.0 per cent. of organic matters, and 14.1 per cent. of phosphates of lime and magnesia, besides some common salt, a little carbonate of lime, small portions of sulphate and carbonate of ammonia, and only 1.0 per cent of water. The nitrogen of this manure, which is almost wholly in the form of organic matters, corresponds to 14.5 per cent of ammonia, and we may estimate the phosphoric acid, which is here present in an insoluble form, at 7.0 per cent. If we calculate the value of this manure according to the rules above laid down, we shall have as follows for 100 pounds :—

Ammonia,—14½ pounds, at 14 cents,...........	$2.03
Phosphoric Acid,—7 pounds, at 4½ cents.......	0.31½
	$2.34½

This is equal to $47 the ton of 2000 pounds ; the manufactured product of Concarneau, however, according to Payen, is sold in the nearest shipping ports at 20 francs the 100 kilogrammes, (equal to 220 pounds), which, counting the franc at $0.20, is equivalent only to $1.81, the 100 pounds, or a little over $37 the ton. This however was in 1854, since which time the price of manures has probably increased.

Mr. Démolon in company with his brother, has also according to Payen, erected a large establishment for the manufacture of this manure on the coast of Newfoundland, at Kerpon, near the eastern entrance of the Strait of Bellisle, in a harbor which is greatly resorted to by the vessels engaged in the cod-fishery This manufactory, now in successful operation, is able to produce 8,000 or 10,000 tons of manure annually. Payen estimates the total yearly produce of the cod-fisheries of the North American coast to be equal to about 1,500,000 tons of fresh fish ; of this, one-half is refuse, and is thrown into the sea or left to decay on the shore, while if treated by the process of Démolon, it would

yield more than 150,000 tons of a manure nearly equal in value to the guano of the Peruvian islands, which now furnish annually from 300,000 to 400,000 tons. If to the manure which might be obtained from the cod-fisheries of the Lower Provinces, we add that of many other great fisheries, we are surprised at the immense resources for agriculture now neglected, which may be drawn at a little expense from the sea, and even from the otherwise worthless refuse of another industry. To this may be added vast quantities of other fish, which at certain seasons and on some coasts are so abundant that they are even taken for the express purpose of spreading upon the adjacent lands, and which would greatly extend the resources of this new manufacture. The oil, whole extraction is made an object of economic importance in the fabrication of manure from sardines, in France, exists in but very small quantities in the cod, but in the herring it equals 10 per cent. of the recent fish, and in some other species rises to 3.0 and 4.0 per cent.

Mr. Duncan Bruce of Gaspé has lately been endeavoring to introduce the manufacture of fish-manure into Canada; but he has conceived the idea of combining the fish offal with a large amount of calcined shale, under the impression that the manure thus prepared will have the effect of driving away insects from the plants to which it is applied. He employs a black bituminous shale from Port Daniel, and distilling this at a red heat, passes the disengaged vapours into a vat containing the fish, which by a gentle and continued heat, have been reduced to a pulpy mass. The calcined shale is then ground to powder and mingled with the fish, and the whole dried. Experiments made with this manure appear to have given very satisfactory results, and it is said to have had the effect of driving away insects when applied to growing crops, a result which may be due to the small amount of bituminous matter in the products of the distillation of the shale, rather than to the admixture of the calcined residue. Coal-tar is known to be an efficient agent for the destruction of insects, and in a recent number of the journal, *Le Cosmos*, it is stated that simply painting the wood-work of the inside of green-houses with coal-tar has the effect of expelling from them all noxious insects. Mr. Bruce caused several analyses of this shale to be made by Dr. Reid of New York, from which it appears that differerent specimens contain from 2·0 to 26·0 per cent. of carbonate of lime, besides from 1·4 to 2·0 per

cent. of carbon remaining after distillation. The amount of volatile matter, described by Dr. Reid as consisting of water, naphtha and ammonia, was found by him in two different samples to equal only 3·5 per cent., of which a large proportion is probably water.

I have examined two specimens of manure prepared by Mr Bruce from the fish commonly known as the menhadden (*Alosa menhadden*). No. 1 was made with the Port Daniel shale, as before described; while for No. 2, this was replaced by a mixture of clay and saw-dust, which was distilled like the shale, the volatile products being added to the decomposing fish. The oil which rose to the surface of the liquid mass had been separated from the second preparation, but remained mingled with the first. both of these specimens were in the form of a black granular mass, moist, cohering under pressure, and having a very fishy odour. A proximate analysis of these manures was first effected by exposing a weighed portion to a temperature of 200° F. till it no longer lost weight, and then calcining the residue, from which the carbonaceous residue very readily burned away. The oil in the first specimen was obtained by digesting a second portion, previously dried, with either, so long as anything was taken up. The solution by evaporation left the oil, whose weight was deducted from the loss by ignition. The portion of oil remaining in the second sample was not determined.

	I.	II.
Animal matter and carbon,	23.7	21·0
Oil,	6·6	
Water,	13·5	21·8
Earthy matters,	56·2	57·2
	100·0	100·0

The residue of the calcination was digested with hydrochloric acid, which dissolved the phosphate of lime from the fish-bones, together with portions of lime, magnesia, alumina, and oxyd of iron, derived from the shale and clay. The solution from No. 1 contained, moreover, a considerable portion of sulphate from the gypsum of the shale. Small quantities of common salt were also removed by water from the calcined residues. The dissolved phosphoric acid, lime, and magnesia were separated by precipitating the phosphoric acid, in combination with peroxyd of iron, from a boiling acetic solution and were determined according to

the method of Fresenius. The nitrogen of the organic matter was estimated by the direct method of burning a portion of the dried substance with soda lime, and weighing the disengaged ammonia as ammonia-chlorid of platinum. The results were as follows for a hundred parts:—

	I.	II.
Phosphoric acid, ...	3·40	3·99
Sulphuric acid, ...	2.16	·15
Lime, ...	5·90	4·44
Magnesia, ...	1·20	1·15
Ammonia, ...	3 76	2·60

If we calculate the value of the fi st specimen according to the rules already laid down, we have as follows for 100 pounds:—

Phosphoric acid, 3 4 pounds at $4\frac{1}{2}$ cents, ...	$0·153
Ammonia $3\frac{3}{4}$ pounds at 14 cents, ...	0·525
	$0·678

At 68 cents the 100 pounds, this manure would be worth $13.60 the ton. The sulphuric acid is of small value, corresponding to 80 pounds of plaster of Paris to the ton, and we do not take it into the calculation. The somewhat larger amount of phosphoric acid in the second specimen, is probably derived in part from the ashes of the saw-dust, and in part from the clay. The value of this manure would be $10·88 the ton.

In order to arrive at the real value of the animal portion of this manure after the removal of the oil, we may suppose, since Dr. Reid obtained from the shales from 4·5 to 7 6 per cent. of fixed carbon, that with the 56.2 parts of calcined residue, there were originally 3·7 parts of carbon derived from the shales. This deducted from 23·7 parts leaves 20·0 of nitrogenized animal matter in 100 parts of the manure, yielding 3·76 parts, or 18·8 per cent. of ammonia. This matter consists chiefly of muscular and gelatinous tissues, and Payen obtained from the dried muscle of the cod-fish, 16·8 per cent. of nitrogen, equal to 20·4 of ammonia. The 24·4 parts of phosphoric acid in the manure will correspond to 7·4 of bone-phosphate, and if to this we add for moisture, impurities, etc., 2·6 parts, = 3·00 in all, we should have for 100 pounds of

the fish when freed from oil and dried, the following quantities of ammonia and phosphoric acid :—

Ammonia,—$12\frac{1}{2}$ pounds at 14 cents,........	\$1.75
Phosphoric acid,—$11\frac{1}{3}$ pounds at $4\frac{1}{2}$ cents,..	0·51
	\$2·26

The matter thus prepared would have a value of \$45.20 the ton, agreeing closely with that which we have calculated for the manure manufactured from sardines in France, in which the quantity of ammonia is somewhat greater, and the phosphoric acid less, giving it a value of \$47 the ton.

Prof. George H. Cook of New Jersey, in an analysis of the menhadden, obtained from 100 parts of the dried fish, 16·7 parts of oil, besides 61·6 of azotized matters yielding 9·28 parts of ammonia, and 21·7 of inorganic matters, etc., containing 7·78 of phosphoric acid.* If we deduct the oil, we shall have for 100 parts of the fish, according to this analysis, 11.2 of ammonia, and 9·3 of phosphoric acid.

By comparing these figures with the results calculated for the animal portion of Mr. Bruce's manures, we find :

	Ammonia.	Phosphoric acid ;
Manure from sardines (Payen),........	14·5	7·0
Dried menhadden (Cooke),...........	11·2	9·3
Manures by Mr. Bruce................	3·75	3·4
" " (excluding shale),.	12·5	11·3

The proportion of phosphates is of course greater in the more bony fishes. In the manure of Mr. Bruce there are doubtless small amounts of phosphoric acid and ammonia, derived from the shale and the products of its distillation ; but these do not however warrant the introduction of an inert material which reduces more than two-thirds the commercial value of the manure. The results which we have given clearly show that by the application of a process similar to that now applied in France and in Newfoundland, which consists in cooking the fish, pressing it to extract the oil and water, drying by artificial heat, and grinding it to powder, it is easy to prepare a concentrated manure, whose value, as a source of phosphoric acid and ammonia, will be in round numbers, about \$40 the ton.

* Report of the Geological Survey of New Jersey for 1856, p. 93.

We can scarcely doubt that by the application of this process a new source of profit may be found in the fisheries of the Gulf, which will not only render us independent of foreign guano, now brought into the Province to some extent, but will enable us to export large quantities of a most valuable concentrated manure, at prices which will be found remunerative.

ARTICLE III.—*Additional Notes on the Post-Pliocene Deposits of the St. Lawrence Valley.* By J. W. Dawson, LL.D., F.G.S., &c.

(Read before the Natural History Society of Montreal.)

In a paper on the Newer Pliocene and Post Pliocene deposits of the vicinity of Montreal, communicated to the Natural History Society last winter, I promised to follow up the subject, especially in the direction of the more minute organisms of these deposits, and the comparison of the stratigraphical arrangements near Montreal with those in other parts of the Province. In fulfilment of this promise, I now proceed to state a number of facts which I have ascertained or which have been communicated to me in the past summer.

I. Foraminifera and Bryozoa.

The Foraminifera are creatures almost at the extreme limit of simplicity of structure in the animal kingdom. Generally microscopic in dimensions and consisting of a soft and apparently homogeneous jelly, they present no appreciable organs, except little thread-like extensions of their bodies, which appear to be their organs of prehension and locomotion. Such creatures might at first sight be supposed incapable of being preserved among the medals of creation. They have, however, the power of secreting for their protection delicate and beautiful calcareous cells, divided into a number of chambers which are added successively in the progress of growth, and communicate with each other and with the outer world by minute orifices; and as these creatures abound everywhere in the ocean, their shells are constantly accumulating on its bottom, so as in some cases so form thick beds of calcareous matter. The Bryozoa, equally minute in size, are far more complex in structure; presenting, with a general polyp form,

complicated digestive and muscular apparatus, which place them far in advance of the hydroid polyps, and have induced the majority of modern zoologists to arrange them with the mollusks. They occupy horny or calcareous cells, which usually have wide openings for the extension of the arms or tentacles which procure the food of the inmates. These cells are arranged in branching or flat and circular groups, which form a large proportion of the zoophytes of the older naturalists, and are to be found everywhere on submerged stones, shells, and sea-weeds.

I place these two tribes, in their structure so dissimilar, together, because they are found together in the drift deposits; and because, owing to this and to their microscopic size, they can be conveniently studied in connection.

Before proceeding to describe the species found, I may mention that though the minute dimensions of these objects may cause them to escape the notice of many collectors, they are, when studied with the aid of the microscope, not inferior in interest and beauty to any other fossils found in our tertiary plains. The Foraminifera may easily be detected by examining the clays in which fossil shells occur, and particularly those holding *Fusus tornatus* and the spicula of *Tethea Logani*,* with the aid of a pocket lens. When they are thus ascertained to be present, a quantity of the clay should be well dried, broken into small pieces, and stirred in a quantity of water, when the clay will subside and the little shells may be skimmed from the surface. When dry they may be spread on a tray or on dark-colored paper, and examined with the lens to ascertain what forms are present. They may then be picked up with a moist camel's-hair pencil, and placed separately in small boxes for more minute examination. For the microscope, they may be mounted either on a dark ground as opaque objects, or in Canada balsam as transparent objects; and should be studied in both of these ways. With the foraminifera, the collector will usually find valves of *Cytheridea*, some of the smaller univalves, and detached cells of *Lepralia*.

(1.) *Position of Foraminifera and Bryozoa in the Post Pliocene Deposits.*

Logan's Farm.—In the last volume of the Naturalist, I de-

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* For notices of these and other fossils referred to in these pages, see my former paper, Canad. Nat. vol. 2.

scribed a number of species of fossils from Logan's farm, and stated what I believed to be their relative position. By the kindness of Mr. Logan, I have since been enabled to make an excavation in the spot where these remains are most abundant, and obtained the following section :—

	ft.	in.
Soil and sand,	1	9
Tough reddish clay,	0	0½
Gray sand, a few specimens of *Saxicava rugosa*, *Mytilus edulis*, *Tellina Grœnlandica*, and *Mya arenaria*, the valves generally united,	0	8
Tough reddish clay, a few shells of *Astarte Laurentiana*, and *Leda Portlandica*,	1	1
Gray sand, containing detached valves of *Saxicava rugosa*, *Mya truncata*, and *Tellina Grœnlandica ;* also *Trichotropis borealis*, and *Balanus crenatus :* the shells in three thin layers	0	8
Sand and clay, with a few shells, principally *Saxicava* in detached valves	1	3
Band of sandy clay, full of *Natica clausa*, *Trichotropis borealis*, *Fusus tornatus*, *Buccinum undatum*, *Astarte Laurentiana*, *Balanus crenatus*, &c. &c., sponges and *Foraminifera*. Nearly all the rare and deep-sea shells of this locality occur in this band,	0	3
Sand and clay, a few shells of *Astarte* and *Saxicava*, and remains of sea-weeds with *Lepralia* attached ; also *Foraminifera*,	2	0
Stony clay, boulder clay.		

It thus appears that at Logan's farm we have littoral species at top, and that all the rare and deep-water fossils, as well as the *Lepraliæ* and *Foraminifera* occur in a comparatively thin band near the base of the deposit. This corresponds precisely with the order observed elsewhere in the vicinity of Montreal ; though at Logan's Farm the arrangement is somewhat more complex than in other localities.

Tanneries.—At the brick-yards near the village of the Tanneries, near Montreal, the surface of the Leda clay is well stored with *Leda Portlandica*. *Astarte Laurentiana*, *Natica clausa* *Tellina Greenlandica*, and some other shells. It also contains sponge spicula and foraminifera. The shells at this place, though by no means so numerous as at Logan's farm, are remarkable for their excellent state of preservation.

Beauport.—I visited this celebrated deposit for the first time last autumn. At first sight it consists of a mass of stratified sand

and gravel, equivalent to the Saxicava sand of Montreal, and resting on boulder clay. The overlying mass is filled with *Saxicava Tellinæ*, &c.; and the underlying boulder clay as usual contains no fossils. My experience in the Montreal deposits, however, led me to expect a bed, however thin, representing the Leda clay, between these; and on searching at the junction of the two great beds above mentioned, I was gratified by finding a layer of sand about three inches in thickness, filled with the rarer shells of the deposit, characteristic of its deeper waters, such as *Fusus tornatus, Pecten Islandicus, Buccinum ciliatum, Modiolaria discors*, &c.* The *Rhynconella psittacea* occurs only in this layer, and in such a manner as to leave no doubt that it is buried here in situ, in the very spot where it lay anchored to the stones of the surface of the drift. On these stones, however, I found a new and interesting field for observation. In the thin layer above referred to, all the stones, as well as those that lay on the surface of the boulder clay or partly imbedded in it, were covered with the remains of marine creatures, especially *Balanus crenatus, Spirorbis sinistrorsa, Spirorbis spirillum, Lepralia* and *Hippothoa*. This layer, in short, evidently represented a time when the surface of the boulder clay, covered only by a thin layer of sand and stones, constituted the bottom of clear and deep water, before it became covered by the Saxicava sand. This bottom, although no clay has been deposited on it, represents the Leda clay at Montreal, and is exceedingly rich in the fossils usually found at the surface of that bed. *Foraminifera* occur in it, but they are comparatively rare, and, so far as I could find, only of species common at Montreal.

(2.) *Species of Foraminifera.*

In my paper of last year a few of these were figured, but the nomenclature of these creatures was in a state so unsettled that I hesitated to attach names to them or to identify them with described species. I am now relieved of the greater part of this difficulty by the appearance of Williamson's excellent monograph on the British Foraminifera, the nomenclature of which I shall follow in noticing our Canadian species.

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* Sir C. Lyell notices the fact that these shells are more abundant in the lower part of the mass than above.

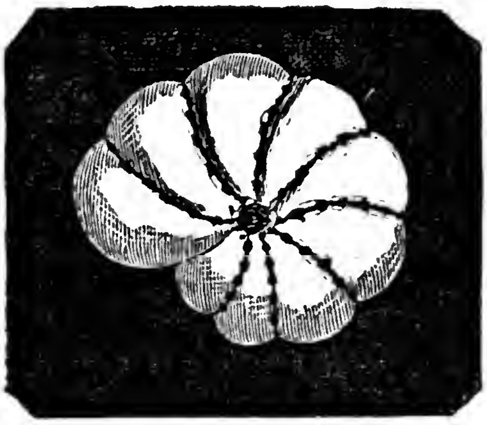

Fig. 1.

1. *Polystomella umbilicatula*, Walker (Fig. 1).*—Nine tenths of the foraminifera from the Montreal clays belong to this species, which also occurs at Beauport, and in equal proportionate abundance living in Gaspé Bay. The specimens all belong to the variety *incerta* of Williamson; and as among many hundreds of specimens I can find none that present the typical characters of the species, and as the general form is also less compressed than in the typical specimens as described and figured by Williamson, I should be inclined to believe this so-called variety in reality a distinct species, were it not for the fact, that, while these curious little creatures are almost indefinitely variable, there is a remarkable persistency of certain varieties in particular localities. The modern specimens from Gaspé correspond precisely with their ancient progenitors of the Post-Pliocene clays. The size of the fossil specimens is large for the species; the diameter of some individuals being $\frac{1}{30}$th of an inch.

Localities.—Logan's farm, Montreal; Brick-yards at Tanneries, Montreal; Beauport; also recent in Gaspé Bay.

2. *Nonionina crassula*, Walker.—Among the fossil specimens of the last species, there are many not distinguishable from it in external form, in which I cannot find, either when viewed as opaque or transparent objects, the characteristic septal apertures of Polystomella. These specimens are usually smaller, more hyaline, and smoother than those showing the apertures. If distinct, they must belong to the species above named. I found no individuals of this description among my recent specimens from Gaspé.

* See also paper in Can. Nat. Vol. 2, Fig. 17.

3. *Polymorphina lactea* (Figs. 2, 3, also paper in Canad. Nat. vol 2). This is perhaps the second species in relative importance, though much less plentiful than *Polystomella umbilicatula.* The greater number of the specimens belong to the variety "*typica*" of Williamson (Fig. 2). Others appear to be an exaggerated form of the variety "*oblonga*" (Fig. 3), and many others, especially the smaller examples, are of the variety "*communis.*" A similar range of varieties exists in the modern specimens from Gaspé. Size $\frac{1}{30}$ to $\frac{1}{50}$.

Localities.—Logan's farm; Tanneries; recent in Gaspé.

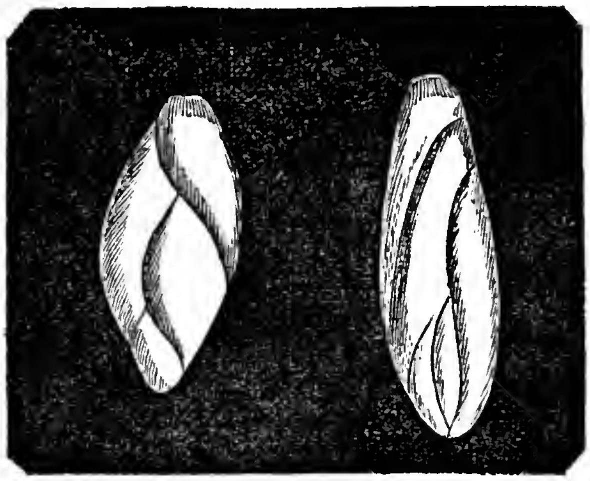

Fig. 2 Fig. 3.

4. *Miliolina seminulum* (Lin.)—(For figure, see paper in Can. Nat. Vol. 2, Fig. 18.) In my paper of last year this species was noticed as *Quinqueloculina occidentalis*, Bailey; and I still believe it to be identical with the shell so named; but I presume that it, as well as many other supposed species of the genus *Quinqueloculina* of D'Orbigny, must be included in *Miliolina Seminulum*, as extended by Williamson. This shell is not infrequent in the clays at Montreal, and it also occurs in Gaspé Bay. It approaches very nearly to the typical form of the species, but is usually of small size, not exceeding $\frac{1}{30}$th of an inch in length.

Locality.—Logan's farm.

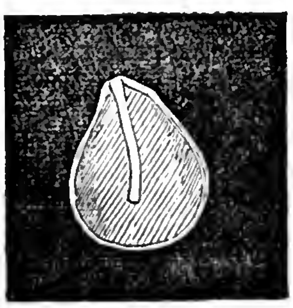

Fig. 4.

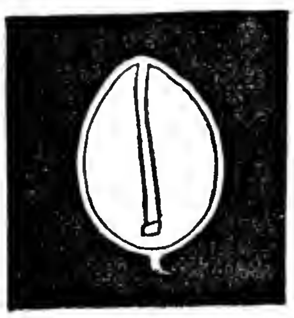

Fig. 5.

5. *Entosolenia globosa* (Figs. 4, 5).—This species is not uncommon in the clay at Montreal. Fig, 21 of my paper of last year is

referable to it, as I had not then observed the internal tube, and supposed it in consequence to be an Orbulina. Figs. 4 and 5 show this internal structure. This species is very small, scarcely exceeding $\frac{1}{100}$th of an inch, and is very smooth and translucent.

Locality.—Logan's farm; Tanneries.

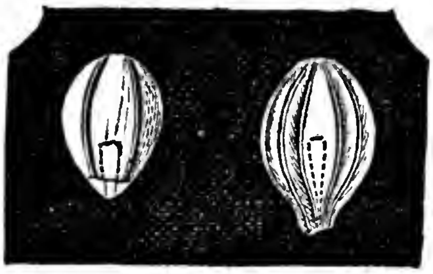

Fig. 6. Fig. 7.

6. *Entosolenia costata*, Williamson (Figs. 6, 7; also Fig. 22 in paper of last year.)—This beautiful little shell differs from that last described only in the possession of longitudinal narrow ribs. Williamson, who had seen only two or three examples, establishes it as a separate species with some doubt; and since in my specimens from the Montreal clays the number and distinctness of the ribs are very variable, I think it probable that this shell is only a variety of *E. globosa.*

Locality as above.

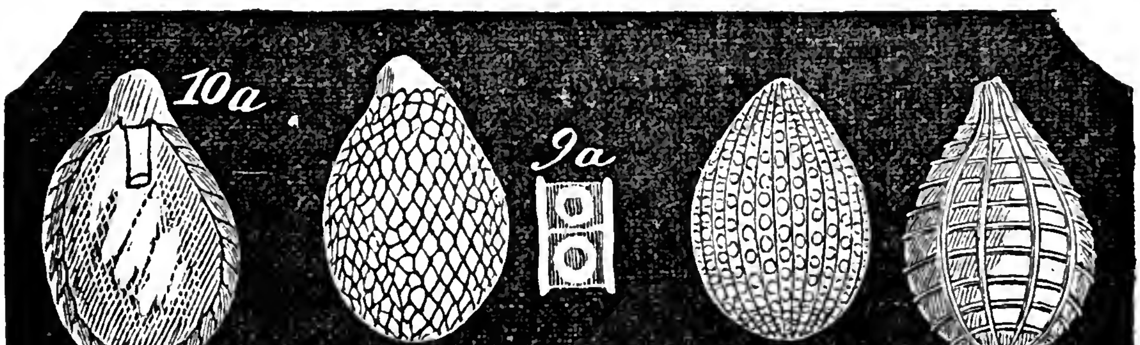

Fig. 10. Fig. 9. Fig. 8.

7. *Entosolenia Squamosa* (Figs. 8, 9, 10).—This, the most elegant of all our Post-Pliocene foraminifera, presents several beautifully ornamented varieties. In the last species the sides are marked by simple longitudinal ribs. In the simple varieties of this the ribs are crossed by more slender transverse bands In others the rectangular spaces thus formed appear to have circles inscribed in them. In others the distinction of longitudinal and transverse ribs disappears, and the whole surface becomes covered with a regular hexagonal network of raised lines of various degrees of fineness. I have endeavoured to represent

several of these forms in the figures; but there are many intermediate varieties, and my wood-cut representations fall far short of the exquisite beauty of the shells themselves, which appear under the microscope as if worked in pure translucent porcelain. Size $\frac{1}{100}$ to $\frac{1}{60}$.

Parker and Jones regard the three species last described as identical. Williamson also leans to this view; and since in my specimens there is a gradation from those that are smooth to those that are ribbed, and from these to those that are netted, I can scarcely hesitate to adopt the same conclusion, in which case the two last species must be regarded as varieties of *E. globosa.*

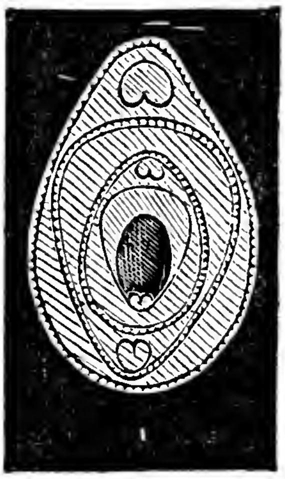

Fig. 11.

8. *Biloculina ringens*, D'Orb. (Fig. 11).—I have found only two specimens of this species, and neither revealed much of its real character until mounted as a transparent object. I have figured one of them as it appears in this way; and it well shows the manner in which the successive cells are added, the orifice being alternately at opposite ends of the shell. Size about $\frac{1}{50}$.

Locality.—Tanneries.

All the species of Foraminifera above noticed are found living as well as fossil. Three of them have been obtained by myself from Gaspé Bay, and the others may probably be found there. The species most abundant in the tertiary clays is also that which prevails in Gaspé Bay, and the conditions of life in both are the same. The Gaspé specimens were found in mud, in from 10 to 15 fathoms, and holding *Leda limatula*, *Tellina calcarea*, and *Astarte sulcata*, so that it may be regarded as strictly equivalent to our Montreal Leda clay, in or at the surface of which the Foraminifera chiefly occur. Two species found at Gaspé have not as yet been recognized in the tertiary clays. One is a globular shell, probably *Orbulina universa*, the other a rough, punctured, yellowish species, probably *Bulimina scabra.*

All the species found in the Canadian tertiary clays are widely distributed in the North Atlantic, and some of them still more extensively. *Polymorphina lactea* is found in the British crag,* and *Entosolenia globosa* in Miocene deposits at Petersburgh, U.S.† They afford little indication of climate, *Miliolina seminulum*, for instance, extending in the present seas from Greenland to Cuba. With respect to depth of water, their indications are probably more precise, though on this subject I can find little reliable information. One fact is certain, that in Gaspé, at present, a depth of 10 to 20 fathoms corresponds bathymetrically, in so far as these creatures are concerned, with that represented by the upper layers of the Leda clay, or brick-clay of Montreal. I have obtained, however, at least one indication that there are still lower depths, not represented as yet by the fossils of our tertiary deposits.

I owe to the kindness of Capt. Orlebar, R.N., two small specimens of fine clay, taken up by the sounding-lead from depths of 187 and 196 fathoms, off Mount Camille, near Bic Island, in the River St. Lawrence. On carefully levigating these specimens, I found in them three species of Foraminifera, all distinct from those of the tertiary clays and of Gaspé, and the silicious shields of a number of microscopic plants (*Diatomaceæ*). The Foraminifera I refer to the following species:—

Rotalina turgida, Williamson. (Fig. 20.)
Spiroloculina depressa, D'Orbigny. (Fig. 21.)
Bulimina auriculata, Bailey. (Fig. 22.)

Fig. 20.

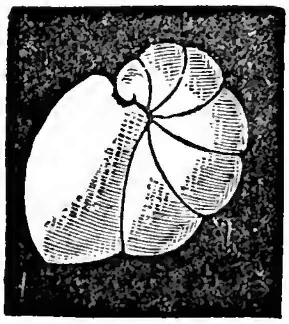

Fig. 21.

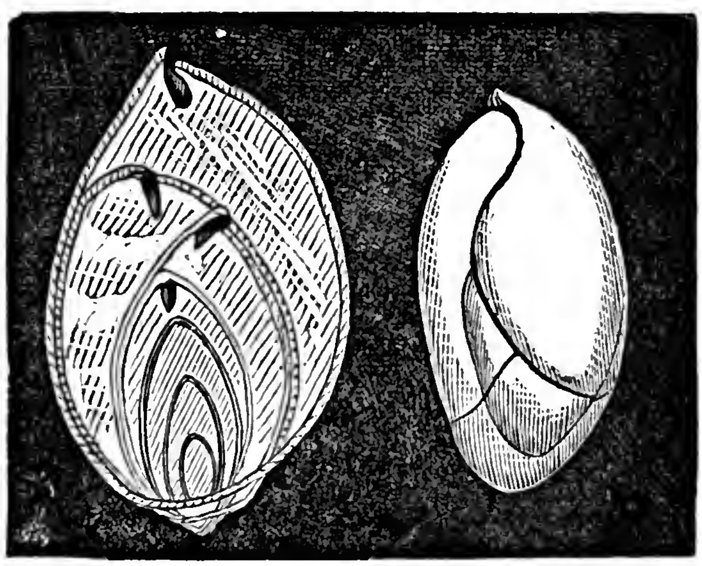

Fig. 22.

* Wood. † Balley.

The Diatomaceæ associated with these shells include *Coscinodiscus lineatus* and species of *Gallionella*, *Eunotia*, *Cocconeis* and *Achnanthes*, most of them apparently identical with forms figured by Bailey. There are also minute acicular spicula of sponges.

Since the highest points at which raised beaches have been found in Canada scarcely reach an elevation of 80 fathoms above the sea level, we can scarcely expect to find on the present land evidence of depths equal to those represented by these soundings. Their containing distinct species from those in the tertiary clays is, however, an interesting fact, and I figure these as a guide to collectors who may be so fortunate as to find them in a fossil state.

(3.) *Species of Bryozoa.*

stones

From the abundance of the remains of these creatures on at the surface of the boulder clay at Beauport, I have no doubt that a number of species might reward a diligent search. My time however at this locality was very limited, and although I brought thence single pebbles with as many as four or five species attached to them, I have no doubt that my collection includes only a small fraction of the species occurring there. The specimens are also in many instances in a defective state of preservation; and as collectors of these objects well know, even in recent specimens it is often very difficult to determine species from the dead cells alone. I am therefore able to name at present only a few species, but these, I trust, may be relied on with some certainty.

1. *Hippothoa catenularia*, Fleming. (Fig. 12.)—This pretty little organism spreads its chains of cells over the tertiary pebbles at Beauport, just as is now does in the Gulf of St. Lawrence; and being of a dense and strong texture, is remarkably well preserved. It belongs at present to the Laminarian and Coralline zones, and is found abundantly in Gaspé Bay in nine fathoms.

2. *Hippothoa divaricata*, Lamour. (Fig. 13.)—This smaller and more delicate species is very abundant at Beauport; but from its minuteness and its similarity in color to the grey, weathered pebbles, may easily escape observation. It differs from the typical form of the species in having the cells united to each other directly, instead of by a slender calcareous thread; but as Johnston* mentions this as sometimes occurring in recent specimens

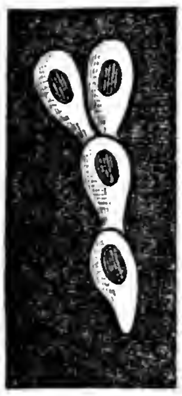

Fig. 12.

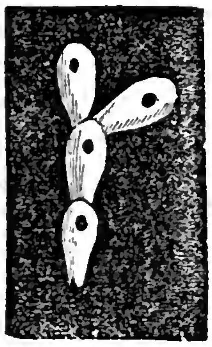

Fig. 13.

Fig. 14.

it may be regarded as merely the characteristic of a variety*. I have not yet found this species living in the Gulf of St. Lawrence.

3. *Tubulipora flabellaris*, Fabricius. (Fig. 14.)—I refer—with some doubt—to this species the organism represented in fig. 14, which occurs sparingly and not in good preservation on stones at Beauport. Fabricius found this species in Greenland, and it occurs in various parts of the North Atlantic. I have not found it living, but it may be the same with the *T. divisa*, a species closely allied to *flabellaris*, found by Stimpson in the Bay of Fundy.

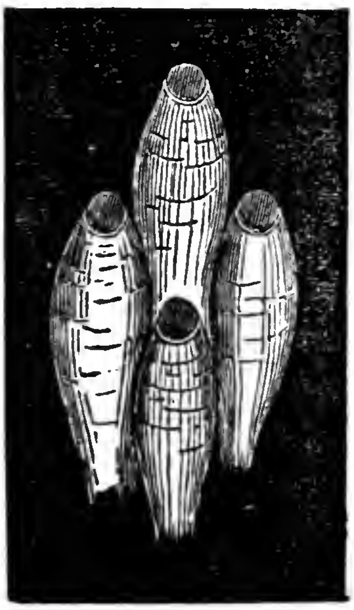

Fig. 15.

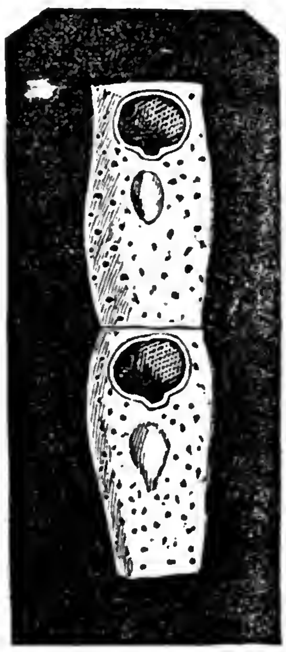

Fig. 16.

4. *Lepralia hyalina*, Lin. (Fig. 15.)—The organism represented in fig. 15 must, I think, be referred to this species. It is found sparingly on stones at Beauport, often nearly covered with the remains of its ovicapsules. It now lives in the Gulf of St. Lawrence and the Banks of Newfoundland.

5. *Lepralia pertusa*, Johnston. (Fig. 16.)—This species is

* British Zoophytes, page 292.

very abundant at Beauport, and, as usual with it, is very variable. The cells represented in fig. 16 belong to the most regular and beautiful variety, which occurs in a state of preservation quite equal to recent specimens. *L. pertusa* is still one of the most abundant forms on the American coast; and the study of the diverse forms of cells which occur in the same patch, is very instructive in relation to the errors likely to arise from basing specific distinctions in these creatures on minute differences in the forms of the cells.

The two last species appear to the naked eye on the stones of the drift, as flat, roundish, white patches, somewhat roughened, like shagreen; and under a lens of low power disclose the forms of their cells.

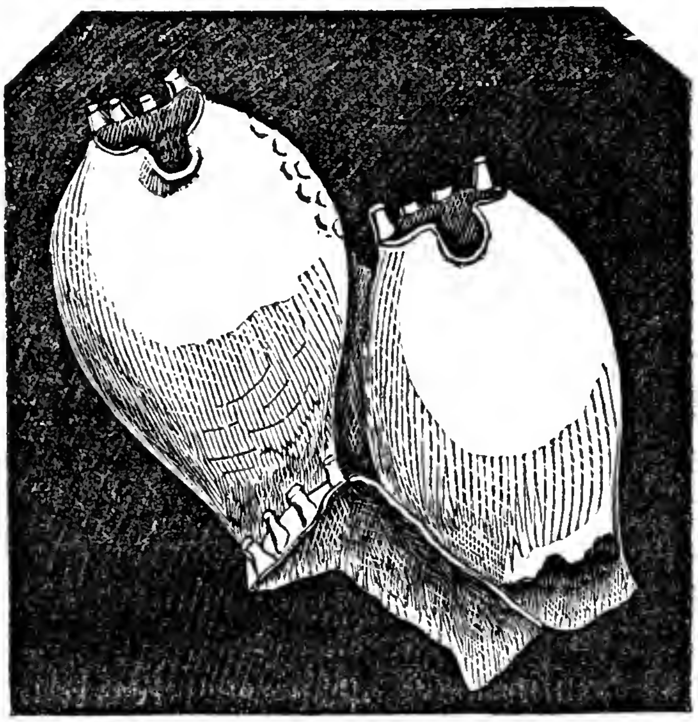

Fig. 17.

7. *Lepralia quadricornuta.* N. S. (Fig. 17.)—This is a large species, the cells being about $\frac{1}{25}$th of an inch in length. It is quite distinct from any species known to me. Its description is as follows:—Cells arranged alternately, ovate, ventricose, smooth on the greater part of the surface, but toward the lower end finely marked with radiating and transverse lines, and at the margins roughened with scaly projections; aperture narrowed, flattened at the distal margin, and armed with four hollow spines, those at the angles strongest; proximal margin deeply sinuated and projecting.

The specimens occur abundantly in the lowest part of the deposit at Logan's farm, and are arranged in such a manner as to

show that they were attached to fronds of algæ which have entirely disappeared. Being imbedded in soft clay, it is much more difficult to secure perfect specimens than in the case of the species attached to stones. From the position of this Lepralia in the deposit, I infer that it lived in very deep water; and it is possible that when we are better acquainted with the deeper parts of the Gulf of St. Lawrence, it may be found there. Having searched in vain for any described species corresponding with it, I propose for it the name of *L. quadricornuta*, founded on its most obvious distinctive character, which is of more importance here than in the case of a recent species, owing to the circumstance that the specimens in the clay usually split in such a manner as to show only the inside of the cells, on which the four horns generally remain sufficiently distinct.

Patches of this Lepralia one inch in length and half an inch in breadth were found at Logan's farm, and the cells were remarkably uniform in size and shape. If found in a living state, its large size and elegant vase-like form will render it one of our finest species. Its nearest allies appear to be *L. ventricosa*, Hassell, *L. trispinosa*, Johnston, and *L. crassispina*, Stimpson.

Before leaving the Bryozoa, it may be well to name the additional species known to me as living in the Gulf of St. Lawrence and likely to occur in the drift:—

Membranipora pilosa, Gaspé, Nova Scotia.
Membranipora, another species, Gaspé.
Flustra Murrayana, Gaspé, Metis, Miss Carey's collection.
Tubulipora patina, Gaspé, Metis, Nova Scotia.
T.——— *penicellata*, Gaspé.
Idmonea Atlantica, Gaspé.
Cellularia neritina, Miss Carey's collection.
Cellularia, another species, Gaspé.

Through the kindness of Andrew Dickson, Esq., I was lately favored with the inspection of a flat stone taken up by the hook of a fisherman on the Banks of Newfoundland, which wonderfully resembles, in its assemblage of species, the stones in the drift at Beauport. It has at one end a group of *Balanus crenatus* of the precise variety so common in the drift; and over various parts of the surface are abundant shells of *Spirorbis sinistrorsa*, with a few of another species not as yet found in the drift. Large portions of the surface are covered with *Lepralia variolosa* and

hyalina; and there is also a *Tubulipora* closely resembling that found at *Beauport*. The shell of a dead *Balanus* contained a little fine sand, among which were small and much rubbed specimens of a *Polystomella* or *Nonionina*, and fragments of spines of *Echini*. This stone is indeed almost a precise modern counterpart of those buried in the drift at Beauport; and they, like it, probably lay in the bottom of a sea loaded in spring with boulder-bearing ice.

I had almost omitted to mention that some of the stones from Beauport, with *Balanus*, *Bryozoa*, &c., bear on their surfaces distinct marks of glacial action, in their polish and striation; and that just as in exposed situations in modern seas, their animal tenants have evidently selected the re-entering angles and least exposed surfaces for their habitations.

II. Fresh-water Shells in the Post-pliocene Deposits.

I have on several occasions found specimens of *Limnea* in the Post-pliocene clays, but always suspected some accidental intermixture. I have been favoured in the past summer, by Andrew Dickson, Esq., with specimens of land and fresh-water shells from the bank of a brook emptying into the Mississippi, a tributary of the Ottawa, two miles below Pakenham Mills, and at an elevation of about 266 feet above Lake St. Peter. They were found in sand and gravel containing *Tellina Grœnlandica*, and which Mr. Dickson thinks is an undisturbed tertiary deposit. The specimens furnished to me afford many internal evidences which would lead me to the same conclusion. The species present are:—

Valvata tricarinata, *Planorbis parvus*,
Planorbis bicarinata, *Amnicola porata*,
Planorbis trivolvis, *Helix striatella ?*
Lymnea elodes ?

As may be seen by reference to the paper by Mr. Billings in the first volume of this journal, all these shells now exist in the Ottawa valley. Proof of their existence there in the Post-pliocene era would be of great interest; and though I am fully aware of the many chances that may cause recent fresh-water shells to be mixed with older deposits, I am strongly inclined to believe that these deposits at Pakenham afford such evidence. Their occurrence is at least deserving of notice, that the attention of geologists may be attracted to the locality.

III. Land Plants.

I am indebted to Andrew Dickson, Esq., for the opportunity of studying a large number of nodules containing plants, collected by him at Green's Creek, on the Ottawa. They contain numerous vegetable fragments, which appear to have been originally distributed over the surface of a tract of clay and covered by similar material, a layer of calcareous nodules subsequently forming along the plane of deposition and imbedding and preserving the remains, which are very little changed, though some of them appear to have been in an advanced state of decomposition before being imbedded. Among them I can recognize leaves or fragments of leaves of the *Populus balsamifera*—which seems to be a very abundant plant at this locality—leaves and stems of grasses, needles of pines, and a moss apparently of the family *Fontinaleæ* or *Hypneæ*.* There is also a well preserved small *dicotyledonous* leaf, which I have not yet been able to identify.

The most curious point in connection with these remains is their association with what seem to be remains of *Algæ*, and with shells of *Leda Portlandica* having the valves cohering. They would thus appear to have been deposited in the sea and in deep water. I observed something of the same kind in Gaspé Bay, where, at the mouth of the North-west river, I found *Leda limatula* living in dark-coloured mud containing vegetable matter, much of it no doubt washed down by streams from the land.

IV. Miscellaneous Fossils.

Ophiocoma.—In my paper of last year I mentioned an organism in a nodule from Ottawa which seemed to be the remains of an ophiuroid star-fish. I have since found similar remains in the Leda clay at the Tanneries, near Montreal. The specimens are entirely disintegrated, but show the internal joints of the rays and also the external plates and spines. From their form I judge that they may have belonged to a small Ophiocoma, not very dissimilar from the *O. bellis* now found in the Gulf of St. Lawrence; but whether identical with that species, or with that found by Sir W. E. Logan at Ottawa, I cannot certainly determine. I figure some of the remains merely to direct the attention of other observers to these curious objects. (Figs. 18, 19.)

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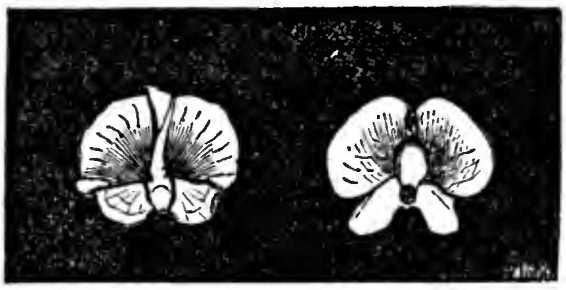
* Sullivant, in a note just received, says it is probably not far from *Hypnum riparium*,



Figs. 18 and 19.—*Joints of Ophiocoma, magnified.*

Modiola glandula.—A single valve of this pretty little shell has been found at Logan's farm. It now inhabits deep water in the Gulf of St. Lawrence. I may also mention that I have found perfect specimens of *Modiolaria discors* both at Logan's farm and Beauport, which quite confirm Dr. Gould's identification of my fragment of last year with that species.

Fusus (*Clavatula*) *turricula.*—Specimens of this shell have been found by Mr. R. Ramsay at the Brick-yards at the Tanneries. It occurs extensively in the North Atlantic, and fossil in the British Crag.

Rissoa.—Since the publication of my last paper, Mr. Bell of the Geological Survey, has shewn to me in that collection a *Rissoa* with five distinct revolving bands, separated by a flattish space from the suture. On comparison of this shell with my specimens referred last year to *R. minuta*, I am inclined to think that they are the same, but that the latter were worn, so as to present a smooth surface. It is not unlike *R. obsoleta* of Wood's Crag Mollusca. I have another little shell which closely resembles *Alvania ascaris* of the same author, but it is too incomplete for its certain identification.

Spirorbis spirillum.—This common species is found of small size, attached to pebbles, at Beauport.

V. General Remarks.

In so far as general conclusions in Geology are concerned, the observations of the past year do not in any way conflict with the conclusions stated in my former paper.

The arrangement of the deposits at Logan's farm and Beauport, confirms the subdivision which I have attempted to establish, of an underlying non-fossiliferous boulder clay, a deep-water bed of clay or sand (the Leda clay of Montreal), and overlying shallow-water sands and gravels, the Saxicava sand of my former paper. This arrangement shows a gradual upheaval of the land from its

state of depression in the boulder-clay period, corresponding with what has been deduced from similar appearances in the Old World. "The upheaval of the bed of the glacial sea," says Forbes, "was not sudden but gradual. The phenomena so well described by Prof. Forchhammer in his essays on the Danish drift, indicating a conversion of a muddy sea of some depth into one choked up with sand banks, are, though not universal, equally evident in the British Isles, especially in Ireland and the Isle of Man."*

We now have in all, exclusive of doubtful forms, sixty-three species of Marine Invertebrates from the Post-Pliocene or Pleistocene clays of the St. Lawrence valley. All, except four or five species belonging to the older or deep-water part of the deposit, are known as living shells of the Arctic or Boreal regions of the Atlantic. About half of the species are fossil in the Pleistocene of Great Britain. A majority of the whole are now living in the Gulf of St. Lawrence and on the neighbouring coasts; and I have reason to believe that the dredging operations carried on by the officers of the Geological Survey in the past summer, will enable us to recognize all but a few as living Canadian species. In so far, then, as marine life is concerned, the modern period in this country is connected with that of the boulder clay by an unbroken chain of animal existence. These deposits in Lower Canada afford no indications of the terrestrial fauna; but the remains of *Elephas Primigenius* in beds of similar age in Upper Canada,† show that during the period in question great changes occurred among the animals of the land; and we may hope to find similar evidences in Lower Canada, especially in localities where, as on the Ottawa, the debris of land-plants and land-shells occur in the marine deposits.

* Memoirs of Geological Survey.

† Reports of Geol. Survey; Lyell's Travels.

ARTICLE IV.—*Report on the Fisheries of the Gulf of Saint Lawrence.* By M. H. PERLEY, Esq., Her Majesty's Emigration Officer at Saint John, N.B.*

Laid before the House of Assembly by command of His Excellency the Lieutenant Governor, and ordered to be printed 8th March, 1849.

There is probably no part of the world in which such extensive and valuable Fisheries are to be found, as within the Gulf of Saint Lawrence. Nature has bountifully provided within its waters, the utmost abundance of those fishes which are of the greatest importance to man, as affording not only nutritious and wholesome food, but also the means of profitable employment.

These Fisheries may be prosecuted as well in the open waters of the Gulf, as within every Bay, Harbour, Creek, Cove, and Inlet in connection with it. Whether on the bleak and sterile coast of Labrador; or on the western coasts of Newfoundland and Cape Breton; or along the eastern shores of Nova Scotia and New Brunswick; or within the Bay of Chaleur; or around Prince Edward Island, Anticosti, or the Magdalen Islands, the Fisherman may pursue his labours with nearly equal chances of success, and the full prospect of securing an ample reward for his toil.

With such valuable and unlimited Fisheries in close proximity to these Colonies, and as it may be said at the very doors of the inhabitants, it is no less strange than true, that they are prosecuted to the greatest extent, and with most profit, by citizens of France, and of the United States.

The French exercise an almost exclusive right of fishing upon the western coast of Newfoundland, the fertility and great mineral wealth of which have only recently become known, and are not yet fully appreciated.

From seven to eight hundred sail of America fishing vessels enter the Gulf of Saint Lawrence annually; and scattering over the whole of its wide extent, with little heed of the limits to which they are restricted by treaty, pursue their business unmolested, and but rarely leave their stations without full and valuable fares.

The Jersey merchants also prosecute these Fisheries with great zeal and assiduity, and, as it is believed, with much profit. They have permanent establishments and Fishing Stations in Gaspé,

* This Report although issued ten years ago, contains the best account of the Fisheries of the Gulf at present extant. Believing it to be important on account of the statistical and natural history information that may be gleaned from it, we republish it without abridgement.

E. B.

Labrador, and Newfoundland, and three or more establishments in New Brunswick; but they by no means confine themselves to any particular locality. They employ upwards of one hundred vessels almost exclusively in carrying the rich products of the deep to various foreign markets, besides the smaller craft required upon the coast. Two of the leading Jersey firms, Messieurs Robin and Company, and Nicolle Brothers, are supposed respectively to afford employment, directly or indirectly, to nearly one thousand persons.

The inhabitants of those shores of Cape Breton and Nova Scotia which are within the Gulf, pursue the Fisheries in their immediate neighbourhood to a moderate extent; and a few of their vessels visit the Magdalen Islands, and the Labrador coast, during the season. The people of Prince Edward Island, who are favourably placed for securing a goodly portion of the riches of the sea, make still more limited efforts; but their efforts can scarcely be described as more limited, or more feeble, than those of the people of New Brunswick, who dwell upon its shores, from Baie Verte to the western extremity of the Bay of Chaleur—those shores commanding as great an extent and variety of fishing ground, and as abundant supplies of valuable fish of every description, as can be found in any other part of the unrivalled Gulf of Saint Lawrence, while they possess equal, and perhaps superior, facilities for prosecuting its Fisheries, both extensively and profitably.

The most valuable Fisheries of the Gulf are those for Herring, Cod, and Mackerel. But before entering upon the question of their encouragement and extension, by increased facilities of communication, it will be proper to give some description of each. With this view they will be taken up in the order of the fishing season; after which, the secondary Fisheries of the Gulf will be briefly noticed.

THE HERRING.

The common Herring (*Clupea harengus*) appears in the Gulf of Saint Lawrence at the end of April, or early in May, and the fishing continues until about 10th June, when they retire to deep water, having deposited their spawn. These "Spring Herring," as they are termed, are taken in "set nets" along the whole eastern shore of New Brunswick, around Miscou Island, and within the Bay of Chaleur. Being caught while in the very act of spawning, they are thin and poor, of little value as an article of food, whether fresh or salted. Another Herring appears on the

coast about the 20th August, and remains in-shore for a month; these are fat and in good condition, furnishing excellent food, and a valuable commodity for export. It is admitted, that when first caught, these "Fall Herrings" are fully equal in every respect to the best Scotch Herrings; and if they were cured in the Dutch manner, this Fishery, from the increased price, and demand, would become one of the most important and valuable Fisheries of the Gulf.

The Herring is the animal delicacy of Holland, and there enjoys a very different reputation, from that of the common salt Herring of Britain or America; yet the fish of both Holland and Britain are the same, being caught on the same fishing grounds, and those of North America are in no respect inferior.

The Dutch mode of curing Herrings is thus described by Mr. Chambers, in his "Tour in Holland in 1838." "Immediately on being caught, the Herrings are *bled*, *gutted*, *cleaned*, *salted*, *and barrelled*. The bleeding is effected by cutting them across the back of the neck, and then hanging them up for a few seconds by the tail. By being thus relieved of the blood, the fish retain a certain sweetness of flavour, and delicacy of flesh *which unbled Herrings cannot possibly possess*. The rapidity of the process of curing, must likewise aid in preserving the native delicacy of the animal, for the Herring lies salted in the barrel, in a very few minutes after it has been swimming in the water. I was assured that the superiority of the Dutch Herrings is solely ascribable to this mode of curing."

The greater mercantile value of the Dutch Herrings, on the Continent of Europe, being found to arisesolely from this mode of curing, the Commissioners of the British Fisheries (in Scotland) were induced to devote great attention to it, and to urge its general adoption by every means in their power. Their officers and inspectors were directed to brand every barrel of Herring, cured according to the Dutch mode, with the figure of the Crown. In their official Report for 1844, the Commissioners state that—"the unprecedented demand from the Continent for Crown brand Herrings, is a sufficient proof of the care with which the integrity of the brand is preserved, as well as of the high value which is set upon it, in all the Continental markets. It was the strong conviction impressed upon the minds of the Commissioners, of the vital importance of preserving the integrity of the brand, which compelled them to exercise the painful duty of dismissing from the service, one of the Board's oldest officers. As he had branded a cargo of

Herrings, which afterwards went to Hamburg, where they were complained of, as having been found unworthy of the brand, the Board despatched the General Inspector of the East coast to that place, in order that he might rigidly examine the contents of all the barrels; and on receiving an unfavourable report as to the result of his investigation, the officer was immediately dismissed. The effect of this prompt measure has been, to raise the character of the brand even higher in the estimation of the Foreign Fish Merchants, to whom the circumstances were generally known. It is by the preservation of the purity of the official brand, that the produce of the British Herring Fishery is to be upheld in character abroad, and the demand for it largely extended in Foreign Markets."

As a proof of the gradually increasing confidence which the Crown brand received on the Continent, the Commissioners furnish a statement of the number of barrels exported to the Continent, during the preceding seven years, commencing with 57,388 barrels in 1837, and annually increasing to 181,583 barrels in 1843.

The Commissioners further say—"An extensive export Merchant has given it as his opinion, that if great care shall be continued in the selection, cure, and official Inspection of the Fish, the Continent of Europe would consume more British Herrings than are now caught in our fisheries. Although they have to contend with all the disadvantages of a duty levied on them of ten shillings per barrel, British Herrings are now brought into competition with Belgian Fish in their own markets, and are annually diminishing the sale of Dutch Herrings, by furnishing part of the supplies in markets formerly entirely dependant on them. By this means their price has been so reduced, that the number of "busses" fitted out for the deep sea Herring Fishery, has been already considerably diminished."

In their Report for 1845, the Commissioners say—"The increasing demand for British Herrings of late years in Germany, arises from their moderate price, their careful selection, their superior cure and quality, and above all, from the security which dealers have in the official brands. The general stipulation between sellers and buyers is, to deliver and receive "Crown" "and Full" branded Herrings; and Mr. Miller, the Inspector of the East Coast, states in a Report made to the Board, of the information gathered by him during a short tour of inquiry made by order of the Commissioners, that he has the authority of a firm at Stetting

for stating, that they sold about 40,000 barrels of Crown and Full branded Herrings last year, which were every where received without objection. The Inspector found British Herrings at Berlin, Wittemberg, Leipsic, Frankfort, Cologne, and Brussels; and he saw several parcels in transit for more distant parts; the barrels were all Crown and Full branded, and the Fish were in fine condition, all well meriting the official brand, and much approved by every one. He frequently inquired for Dutch Herrings, and was uniformerly shown British Herrings as Dutch; and when he stated that they were British, they always insisted that they were Dutch, and they sold them as Dutch. So general is the use of British Herrings on the Continent, that at Embden, where, a few, years ago, fifty vessels were annually fitted out for the Fishery, and a bounty of about £50 paid to each, the number of vessels was reduced to twelve, notwithstanding the continuation of that bounty. The Inspector General learned from the British Consul at Frankfort, that the navigation of the Rhine to Mayence, or Frankfort, has not been attempted by vessels laden with British Herrings, in consequence of the jealousy of the Dutch, who throw insuperable obstacles in the way. Those Herrings which have been sent thither, were transhipped at Rotterdam, when the charges levied in Holland, proved to be almost prohibitory. But as the prospect has arisen of immediate transport by a Canal connecting the Maine with the Danube, the Catholic countries of Bavaria, Hungary, and Austria, may be expected to afford new markets for our Herrings, when the navigation of the Rhine may be attempted, or when the Railway from Antwerp to Cologne may be employed."

These extracts from official reports of the highest character, show most clearly the increased value which the Dutch mode of curing gives to British Herrings; while the careful inspection, and the rigid measures adopted to preserve the integrity of the official brand, indicate in the strongest manner, the necessity for a similar inspection in New Brunswick. At present, from the entire absence of both skill and care, one of the most prolific and most valuable Fisheries of the Gulf is rendered of the least value, and there is a complete waste of the bounties of Providence. Herrings are taken in the largest quantities, at a season when they are almost unfit to be eaten, because they are then caught with the greatest ease, and at least expense, and thousands of barrels are found of so little worth, that they are used to manure the land, or are left to rot upon the beaches.

In the autumn, when the Herrings are in fine condition, they are taken during a few weeks only, because our fishermen are quite ignorant of the proper mode of curing to render them of value, and are not aware of the manner of using drift nets in deep water, which is so successfully practised by the Herring Fishers of Loch Fyne, and other noted stations in Scotland. By a similar manner of fishing, our fishermen could continue to catch Herrings until the latest period of the fishing season, and those taken last would be of the finest quality. The mode of fishing by drift nets, is thus described by Mr. Yarrell, in his admirable work on British Fishes:

"The net is suspended by its upper edge, from the drift rope, by various shorter and smaller ropes, called buoy ropes; and considerable practicable skill is required in the arrangement, that the net may hang with the meshes square, smooth, and even, in the water, and at the proper depth; for, according to the wind, tide, situation of their food, and other causes, the Herrings swim at various distances below the surface."

"The size of the boat depends on the distances from shore at which the fishery is carried on; but whether in deep or in shallow water, the nets are only in actual use during the night. It is found that the Fish strike the nets in much great numbers when it is dark, than while it is light; the darkest nights, therefore, and those in which the surface of the water is ruffled by a breeze, are considered the most favourable. It is supposed that nets stretched in the day time alarm the Fish, and cause them to quit the place where that practice is followed; it is, therefore, strictly forbidden."

Many thousands of barrels of the inferior "Spring Herring," are taken at the Magdalen Islands every season, at the period when they approach the shores of these Islands to deposit their spawn. They are then very poor, and as but little care is taken in curing them, they often prove unfit for human food. They are caught in large seines, which require 15 or 20, and sometimes 40 men to manage them; and they are capable of enclosing, and bringing to the shore, from 200 to 1000 barrels at a single haul. When taken from these seines, it is the common practice to put them in the holds of the vessels, without washing, bleeding, or divesting them of their offal. They are salted "in bulk," as it is termed, and so they remain until the vessel arrives at the Port whence she sailed, whether in the Colonies, or in the United States. They are then taken out and packed in barrels, sweltering in all their impurity; but whole cargoes frequently prove worthless as food, and are used for dressing grass land.

The number of barrels of Herrings exported from the several Ports in the Counties of Restigouche, Gloucester, Northumberland, and Kent, during the last eight years, is thus stated:—

Ports.	1841	1842	1843	1844	1845	1846	1847	1848	Totals.
Restigouche,	13	....	....	....	41	....	75	....	129
Bathurst,	....	....	....	20	52	....	....	280	352
Caraquette,	26	87	16	50	110	437	396	28	1150
Miramichi,	140	346	219	1080	3732	1192	1189	....	7898
Richibucto,	....	....	100	....	49	120	93	48	410
Totals,	179	433	335	1150	3984	1749	1753	356	9939

A large proportion of the Herrings exported from the Miramichi, are of the description best known as the Gaspereaux or Alewife, (*Clupea vernalis*) which leave the Sea, and ascend most of the Rivers of the Gulf, to spawn. They are a thin, dry fish, much inferior to the Sea Herring when salted; they find a market in the West Indies, as from their leanness, they are less liable to spoil in a hot climate than the fat Herring.*

From the preceding Table it appears clearly, that beyond furnishing some portion of the food of the inhabitants of the Northern Counties of New Brunswick, the magnificent and unlimited Herring Fishery of the Gulf of Saint Lawrence and Bay of Chaleur, barely furnishes a sufficient quantity for export to prevent Herrings being altogether omitted from the Returns.

Of all the Fisheries of the Gulf of Saint Lawrence, none could be increased to a greater extent, or would furnish a more valuable export, than the Herring Fishery, if placed under judicious regulations, and conducted with greater skill and care. The manner of taking Herrings by drift-nets in deep water, requires to be generally known and adopted. At present, these excellent and truly valuable Fish, which exist in the Gulf in myriads, during the latter part of the season, when they are in the finest condition, are only caught in sufficient quantities to furnish bait for Cod, and a supply for domestic use.

The Dutch mode of curing also requires to be introduced, in order that the full flavour and fine quality of the Fish may be preserved. If cured according to this approved mode, and properly packed in

* Note in 1850.—Since this Report was first published, it has been ascertained that Cuvier, and the American Naturalists, class the Alewife, not as a Herring, but as a species of Shad, and designate it *Alosa vernalis*.

barrels of hard wood, bearing an official brand, (on which full reliance could be placed,) to denote the quality of the Fish within, the Herrings of the Gulf of Saint Lawrence would find a ready market throughout the whole extent of Canada, and would find their way by inland navigation, and the Great Lakes, to the most Western States of the Union, where there exists a large and constantly increasing demand. To other parts of the United States, and to Foreign Ports elsewhere, they might be profitably exported, if they could reach Saint John, at all seasons, at a moderate charge.

The Herring Fishery of the Gulf would be more benefitted than any other, by the construction of Railways, and the increased facilities for communication which they would afford. No other description of Fish would probably furnish so large an amount of Railway traffic, as, if once properly established, this Fishery, which can now be scarcely said to exist, might be prosecuted to an almost unlimited extent.

THE COD.

The Cod Fishery commences from the 1st to the 10th June, and continues until the end of November; it may be prosecuted in every part of the Gulf of Saint Lawrence, to a greater or less extent. The principal Fish caught, differs but little from the *Gadus morrhua*, of Linnæus, or ash-colored Cod. There are besides, two varieties, known as *Gadus rupestris*, the Rock Cod, and *Gadus arenosus*, the Shoal Cod.

Near the Shores of New Brunswick, the best Fishing Grounds, or rather, those most frequented, are from Point Escuminac to Miscou, and thence along the Bay of Chaleur, to the Restigouche.

The inhabitants of the County of Gloucester prosecute the Shore Fishery to a greater extent than any others on the New Brunswick coast. Their principal stations are Miscou, Shippagan, Caraquet, and Grande Ance. They go out in boats, from one to fifteen miles from the land, in the morning, and when at the longer distance, do not return until the evening of the following day. The boats have two fore-and-aft sails, and a jib; each boat is managed by two men, and frequently there is with them a boy. Each man has two lines, from 30 to 48 fathoms in length, and they are also furnished with Mackerel lines, spare leads, and hooks. The boat has oars, an anchor and rope, compass, and small oven for cooking; the cost is about £18 for each boat, with complete outfit. The Fishermen generally build their own boats during the Winter: the

keel is of birch; the timbers of cedar; and the planks of pine or cedar. A boat will last from six to eight years, and so will the sails also, with care.

The quintal, by which Cod are always sold, is 112lb of dry fish. It is considered a good day's fishing, at Miscou, for one of these boats to take ten quintals of Fish, which they frequently do. When first caught, 112 of the small fish, and 30 of the large size, are reckoned to the quintal.

Nearly all the fishermen of Shippagan and the Bay of Chaleur, split, salt, and cure their own fish. When they do not, 252lb of green fish, salted and drained, are given to a curer, to return 112lb of merchantable dry fish.

The boats, as they return from the fishing banks, run alongside a stage built over the water, upon which the fish are thrown out. The first man that handles the fish cuts its throat with a single stroke of his knife, and slides it along a sort of table to another, who whips off the head, and throws it, with the entrails, through a hole in the table, into the water underneath, retaining only the liver, which is thrown into a tierce to make oil. The next man splits the fish, and takes out the back-bone; on the manner in which these operations are performed, the quality of the Fish for market, in a great degree depends. They are then washed, and rubbed with salt, in which they remain for six or eight days; then, being again well washed, they are placed in what is called a "horse pile," to drain. After draining twenty four hours, they are spread out to dry on long narrow wicker frames or stages, set up on purpose, called "flakes." They require to be frequently turned to prevent their being "sun-burnt," or salt-burnt;" and they cure in about three weeks. It is not well to cure them too fast; they are best when dried moderately.

After the Fish are sufficiently cured, they are collected and laid in small circles, with the tails outwards; these circles are continually built upon, each row being larger than the one below it, until the pile is about three feet high, when the circles begin to diminish so as to form a conical roof; this is covered with birch bark, and stones are placed upon it. The piles are thus rendered impervious to the heaviest rains; and in this position, the Fish are left to season before being packed for exportation.

The Bay of Chaleur Cod are more prized in the markets of the Mediterranean, and, will, at all times, sell there more readily, and at higher prices, than any other. They are beautifully white; and

being very dry, can better withstand the effects of a hot climate and long voyage, than a more moist Fish. The peculiarity of their being smaller than Cod caught elsewhere, is also of great importance as regards the South American market, for which they are packed in tubs of a peculiar shape, called "drums," and into which they are closely pressed by means of a powerful screw.

The usual baits for Cod on the New Brunswick Coast, and in the Bay of Chaleur, are—Capelin, in the early part of the season—and afterwards, Herring and Mackerel—when no other baits can be had, Clams are used.

The capelin (*Salmo grœnlandicus*)* is a beautiful little fish, from four to seven inches in length, the under jaw longer than the upper, the colour of the back greenish, the under surface of the body silvery. They usually appear about Miscou, and in the Bay of Chaleur, early in May; but sometimes not until near the end of that month. The Cod Fishery does not fairly commence until the arrival of the Capelin, which continue near the shores until the end of July.

There has been great complaint of late years, in the upper part of the Bay of Chaleur, of the falling off in the Cod Fishery, which is said to be every year decreasing. At Carleton, Maria, New Richmond, and other places on the Gaspé shore, the fishing establishments are deserted, and going to ruin. At these places there was formerly an abundant supply of fish; but the inhabitants now barely catch enough for their own winter store.

This decrease is also felt on the New Brunswick shore. The settlement of Petit Rocher sends out about 50 boats only, which average a catch of 50 quintals each, during the season. The Pockshaw coast sends out a few boats, but they only fish occasionally. The Caraquet and Shippagan boats, further down the Bay, take more than 100 quintals each during the season, which are of better quality than those taken off Petit Rocher. The decline of the Cod Fishery in the upper part of the Bay is attributed to the wanton destruction of the proper and natural food of the Cod—Herring and Capelin—which are taken in immense quantities; not for immediate eating, or for curing, or for bait—but for manuring the land!

In a representation made to the Canadian Legislature by a fisherman of Gaspé, it is stated, that this fisherman has seen five

* This is the *Mallotus villosus* which occurs so well preserved in the fossil state near Ottawa.

hundred barrels of Capelin taken in one tide, expressly for manure; and that he has also seen one thousand barrels of Herring caught at one time, and not taken away, but left to rot upon the beach.

It has been remarked in the Bay of Chaleur, that owing to this waste of the smaller fish, the Cod Fishery recedes, as agriculture advances. The lazy farmer, who thinks he can increase the fertility of his land by a single sweep of his seine, does so at the expense of the fisheries, although a bountiful Providence has furnished the shores with inexhaustible quantities of kelp and sea-weed, and other valuable manures, which really enrich the soil while it is admitted that the use of fish greatly deteriorates it.

The Legislature of Canada has been strongly urged to make it a misdemeanor, punishable by fine and imprisonment, for any person to use either Herring or Capelin as manure; and such a measure would seem to be highly desirable in New Brunswick. To be effective, there should be similar regulations on both sides of the Bay of Chaleur.

The deep-sea fishery for Cod is not prosecuted to any great extent in the Gulf by the people of New Brunswick. A few schooners proceed from the Fishing Stations in the County of Gloucester, already mentioned, to the Bradelle Bank, about fifty miles from Miscou. In the summer of 1839, H. M. S. Champion, in sailing from the East Cape of Prince Edward Island to the Bay of Chaleur, (crossing the Bradelle Bank) passed through a fleet of 600 to 700 sail of American fishing schooners, all engaged in Cod fishing.

The vessels of Gaspe frequently resort to Anticosti, off the eastern end of which Island, Cod are often taken in great abundance and of good quality.

The excellent fishery on the Labrador Coast is prosecuted almost wholly by the Americans, and by vessels from Newfoundland, Canada, and Nova Scotia. The vessels usually employed are schooners of 70 or 80 tons burthen, and they arrive on the coast about the end of May. Every part of the coast is frequented by fishing vessels during the season, from Mount Joli, at the southern boundary of Labrador, to the northern extremity of the Straits of Belleisle. On reaching the coast, the vessel enters some snug harbour, where she is moored, and there remains quietly at anchor, until a full fare, or the departure of the fish, requires the Master to seek another inlet, or return home.

The fishery is carried on entirely in boats, and the number found most useful is one for every thirty tons of the vessel; there

are two men to each boat. If fish are in plenty, and not too distant from the vessel, they are expected in good weather to get two loads each day. The return of the boats with fish is the signal for the dressing crew, who remain on board, to commence their operations. If it is intended that the vessel shall remain on the coast until the fish are ready for market, they are taken on shore as caught, and there dressed, salted, and dried, before being put on board the vessel. But it is the more common practice, especially with vessels from the United States, to salt the fish on board, and take their cargoes home in a green state, drying them after arrival.

The vessels from Nova Scotia and Canada, in general, carry their cargoes home in a green state.

About three hundred schooners from Newfoundland resort to the Labrador Coast every season, during which they usually make two voyages. When they first return from the coast, they take home a cargo of dry fish ; but on the second return voyage, a considerable proportion of the fish in a "green" or pickled state, and is dried at Newfoundland.

The Labrador Coast is indented every where with excellent Harbours, which have been frequented for a very long period. From the security of these Harbours, and the general certainty of an ample supply of fish, this coast is preferred by many fishermen to any other Fishing Station within the Gulf.

The average produce of this fishery may be estimated at ten quintals of dry fish to every ton of the vessels employed; but the Masters of the American schooners are dissatisfied when they fail to catch 12 or 13 quintals per ton. The baits are principally the Capelin and the Herring, both of which abound on that coast. The Herrings taken at Labrador, in the latter part of the season. are considered very fine: yet they are not caught as a chief object of pursuit, but merely as an adjunct to the Cod Fishery.

The quantity of dried Cod exported from New Brunswick Ports, in the Gulf of St. Lawrence, during the last eight years, is thus stated in quintals :—

Ports.	1841	1842	1843	1844	1845	1846	1847	1848	Totals.
Dalhousie, ..	..	..	500	..	..	..	..	..	500
Bathurst, . . .	..	50	..	..	..	..	..	1,091	1,141
Caraquette, .	7770	9638	8670	8841	7456	11,673	8672	14,678	77,398
Miramichi, ..	..	486	300	150	70	272	1398	298	2,974
Richibucto ..	..	..	..	40	..	25	270	..	325
Totals,	7770	10,174	9470	9031	7526	11,970	10,340	16,067	82,438

From this Return it appears, that the export of dried Cod from the Northern Ports of New Brunswick, is chiefly from Caraquette. This export is made almost wholly by the Jersey Houses of Robin and Co., and Le Boutillier, Brothers, of Paspediac in Gaspé, and Alexandre and Co., of Shippagan, to Brazil, Spain, Portugal, Sicily, and the Italian States. The export of Cod from the Gulf of St. Lawrence to Foreign Markets, is a branch of business which the Merchants of New Brunswick have yet to learn.

The quantity of dried Cod exported to Foreign Countries from the District of Gaspé, during the past year (1848,) is thus stated from official Returns:—

Gaspé Basin,	41,269	Quintals.
New Carlisle,	46,523	do.
Total,	87,792	Quintals.

The whole quantity of Dried Cod exported from New Brunswick during the last eight years, is exceeded by the quantity exported from Gaspé during the year 1848 only, by 5,414 quintals.

There is reason to believe, that a considerable proportion of the Cod exported from New Carlisle, is caught on the south side of the Bay of Chaleur, and about Miscou, the fishing grounds being better near the New Brunswick Shores, than on the Gaspé side of the Bay.

The quantity of dried Cod exported from Newfoundland in 1845 was 1,000,333 quintals, of which one-sixth was the produce of the Fishery on the Labrador Coast.*

The whole line of the New Brunswick coast from Shediac to Escuminac, around the Bay of Miramichi, and thence along the shores from Tabusintac to Shippagan and Miscou, offers the greatest facility for prosecuting either the in-shore, deep-sea, or Labrador Cod Fishery. There are numerous harbours, creeks, coves, lagoons, for boats and vessels of every size and description; the beaches are admirable for drying Fish, and there is abundance of wood at

* The French employ 360 vessels, from 100 to 300 tons each, with crews amounting to 17,000 men, in the Newfoundland Fisheries. Their annual catch of Cod averages 1,200,000 quintals. The Government bounty is eleven francs per quintal, which is fully the value of the article itself. A French vessel for the Bank Fishery, of 300 tons, has a crew of at least 40 men, and from 7 to 9 heavy anchors, with 800 fathoms of hemp cable, and 4 or 5 large boats, capable of standing heavy weather.

hand for the construction of stages and "fish-flakes." The soil too, is generally excellent, and owing to the flatness of the coast, the shore is every where easy of approach. For the establishment of Fishing Stations by Merchants of capital and skill, or the organization of Fishing Colonies on an extensive scale, this coast offers rare advantages.

The Bay of Chaleur likewise possesses many advantages for the prosecution of the Fisheries. The whole Bay may be considered one great Harbour, as throughout its entire breadth and extent, there is not a single rock, reef, or shoal. During the summer, it literally swarms with fish of every description known on the shores of British North America; and its ancient Indian name of "Eck-etaun Nemaachi"—the Sea of Fish—well denotes its character.

The facilities for ship building are very great on the New Brunswick side of this Bay. The timber is of excellent quality, and noted for its durability, more especially the larch, which is accounted equal to any in the world. Mr. MacGregor, M. P. for Glasgow, late Secretary to the Board of Trade, in one of his official Reports to that Board, says—"The larch-built vessels of the Bay of Chaleur are remarkably durable. A vessel belonging to Robin and Co., which I saw at Paspediac in 1824, I went on board of again in 1839, in the port of Messina, where she was then discharging a cargo of dry Codfish, to feed the Sicilians. This vessel, then more than thirty years old, was perfectly sound."

The "bultow" mode of fishing for Cod, introduced by the French at Newfoundland, and now being adopted by the English residents there, might very probably be followed with advantage by the fishermen dwelling on the New Brunswick coast.

The "bultow" is described as a long line, with hooks fastened along its whole length, at regular distances, by shorter and smaller cords called *snoods*, which are six feet long, and are placed on the long line twelve feet apart, to prevent the hooks becoming entangled. Near the hooks, these shorter lines or *snoods*, are formed of separate threads, loosely fastened together, to guard against the teeth of the fish. Buoys, buoy ropes, and anchors or grapnels, are fixed to each end of the line; and the lines are always laid, or as it is termed "shot" across the tide; for if the tide runs upon the end of the line, the hooks will become entangled, and the fishing will be wholly lost. These "set-lines" have been some time in use on the coast of Cornwall, in England, and the mode is there

called "bulter" fishing.* A gentleman connected with the British Fishery Board, has suggested an improvement, in fixing a small piece of cork within about twelve inches of the hook, which will suspend and float the bait, when it will be more readily seen by the fish. If a bait rests upon the ground, it is sometimes covered with sea weed, and often devoured by Star fish, Crabs, and Echini.

In a petition from the inhabitants of Byrant's Cove, in Newfoundland, to the Legislature of that Colony, in 1846, it is stated, that the "bultow" mode of fishing had been introduced in that vicinity in the previous year, at first by a single line, or "fleet" as it is termed, of one hundred hooks; and this proved so successful, that before the end of the season, seventy five fleets were used, some of them three hundred fathoms long. The petitioners represent, that the set-line, or "bultow," is the best mode of fishing ever introduced in those waters, as being less expensive in outfit, and in keeping boats in repair. They state that a set-line will last three years, and with care even longer; that the total expense of fitting one out, with a gross of hooks, is only fifty shillings; and that it is not moved during the season, nor taken up, except for overhauling and baiting, until the fish move out in the deep water in the autumn. The petitioners add, that the fish taken by the "bultow" are larger than those taken by the hand line, as also superior in quality; and that it was a common thing, during the preceding season, for one and a half quintals of fish to be taken off a gross of hooks, in overhauling the line of a morning. It appears that the lines are overhauled, and fresh baits placed on the hooks every morning and evening; and it is set forth as an advantage of the "bultow," that if the fisherman leaves it properly baited in the morning, it is fishing for him while he is at work in his garden; whereas, by the other mode, if he was not on the ground, he could not expect fish. The petition then proceeds thus: "Your petitioners therefore pray your honorable House to cause the following rules, or something like them, to pass into law, as like all new inventions, the set-line, or "bultow," has to struggle against many hindrances, from ignorance, and bigotry to the old method, yet, as your Petitioners have endeavoured to show, the "bultow" has proved itself, what may be fully termed, "THE POOR MAN'S FRIEND.

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* Mr. Wallop Brabanon, in his work on the Deep Sea Fisheries of Ireland, says this mode of fishing is much practised on the West Coast of Ireland, where it is called "spilliard," or "spillet" fishing.

The rules which the Petitioners pray may become law are simply that the fishing grounds may be divided into two parts, one for the "bultow," and one for hand-line Fishermen; that the "bultows," shall always be set parallel with each other, that they may not get foul, and may take up as little room as possible; and, lastly that a person conversant with this mode of fishing, may be appointed to enforce these rules, and to instruct those who are not acquainted with the method, in the proper manner of fitting out and setting the "bultow." The Petitioners conclude by stating their belief, that if their suggestions are carried out, the boats now used in the Shore Fishery will, in three years, give place to the "bultow" throughout Newfoundland, as they have already done in Byrant's Cove.

For the Deep-sea Fishery, the "bultow" is of great length. The French fishing vessels chiefly anchor on the Grand Bank of Newfoundland, in about 45 fathoms water, veer out one hundred fathoms of cable, and prepare to catch Cod, with 2 lines, each 3000 fathoms in length. The snoods are arranged as previously described, and the hooks being baited, the lines are neatly coiled in half bushel baskets, clear for running out. The baskets are placed in two strong built lug-sail boats, and at three o'clock in the afternoon, both make sail together, at right angles from the vessel, on opposite sides; when the lines are run out straight, they are sunk to within five feet of the bottom. At day break next morning, the boats proceed to trip the sinkers at the extremities of the lines, and while the crew of each boat are hauling in line and unhooking Fish, the men on board heave in the other end of the lines, with a winch. In this way, four hundred of the large Bank Cod are commonly taken in a night. The Fish are cleaned and salted on board, and stowed in the hold in bulk; the livers are boiled to oil, which is put in large casks secured on deck. The French vessels engaged in this Fishery, are from 150 to 300 tons burthen; they arrive on the Grand Bank early in June, and on the average, complete their cargoes in three months. In fine weather, the largest class of vessels frequently run out three or four "bultows" in different directions from the ship, and thus fish 10,000 fathoms of line, or more, at one time, with a proportionate number of hooks.

Should this mode of fishing be approved, measures might be devised for promoting its adoption near the shores of New Brunswick.

If circumstances should arise to induce the prosecution of the Cod Fisheries of the Gulf of Saint Lawrence, on a more extensive

scale, some regulations will be necessary for an efficient inspection of dried fish intended for exportation to Foreign markets, in order to give a character to the commodity, and prevent carelessness in curing. On this point, the Commissioners of the British Fisheries, in their Report for 1844, say—"It is very gratifying to observe, that there is a gradual increase in the annual export of dried Cod to Spain, where a most extensive market for the consumption of this description of fish, may be fairly looked for, in the course of some years. This can only be obtained by unremitting care on the part of the Board's officers, in their inspection and punching of the fish, the Spaniards being very particular in regard to the excellence of the article they purchase. The Commissioners have judged it right to order an improvement in the form of the official punch used for stamping the dried Cod and Ling, and instead of that lately used, which cut a square figure out of the tail of the fish, for which some private marks used by curers were liable to be mistaken, they have adopted a crown, which is less liable to be imitated."

Besides Cod, there are several species of fish of the same genus, caught in the Gulf, in the prosecution of the Cod Fishery. These are—the Haddock (*Gadus æglefinus*)—the Hake (*Gadus merlucius*)—and the Torsk, or Tusk, (*Gadus brosme.*) These fish are cured in the same manner as Cod, to which, however, they are inferior. They are known commercially as "Scale Fish;" and on the average, they sell at about half the price of Cod.

The Cod fishers in the Gulf often take the large flat-fish, known as the Halibut, (*Hippoglossus vulgaris* of Cuvier) which sometimes attains the weight of 300 lbs. The flesh, though white and firm, is dry, and the muscular fibre coarse. These fish are cut in slices, and pickled in barrels, in which state they sell at half the price of the best Herrings.

(*To be continued.*)

REVIEWS AND NOTICES OF BOOKS.

Proceedings of the Essex Institution, Salem, Mass. Vol. II., Part I. 1856 to 1857.

We have perused this volume with the greatest pleasure. The annual Report of this Society which it contains gives evidence of much life and energy in the prosecution of Natural Science and of History. The aggregate number of its members is three hundred

and seventy-eight. During the year it held thirteen evening meetings for the discussion of subjects connected with the objects of the Institute. These meetings commenced on the 8th Nov., and continued on the 2nd and 4th Mondays of each month. The interest manifested in them, we are informed, gave assurance of their utility. The Society possesses a liberary and museum of great value and interest. During the year a Horticultural Exhibition was held under its auspices. From the report of the Ornithological Committee, we find that the collection is in good condition and well arranged, comprising 209 mounted specimens of North American Birds, containing 148 species; 137 specimens of foreign birds, 12 of foreign bird's nests; 74 do. do. eggs, containing 41 species determined; also 23 species contained in 72 specimens not determined; 50 specimens, containing 32 specimens of American Bird's nests; 200 specimens of American bird's eggs, containing 81 species, not including about 27 species contained in 50 specimens of undetermined ones. This seems to be a favorite department. Large additions have been made to it by donations during the year.

In the Ichthyological section, we find the committee, while complaining somewhat, yet reporting the large number of 263 specimens of American fishes, embracing 26 families, 61 genera, and 80 species; of foreign fishes there in all 144 specimens, embracing 62 species. In Mammalia the collection is certainly very poor, containing only 48 specimens, exclusive of duplicates. In the department of Botany there appears to be a good Herbarium in excellent order, gradually expanding and increasing in value. We note these things to show what can be done by a few zealous students of Natural History.

We would notice as worthy of imitation by our own Society, the appointment by this Institute of curators, not only of special departments, but of sections of each department;—e. g. in the Historical department there are curators in Ethnology, in M.SS., and in the Fine Arts. In Natural History there are curators in Botany, Mammalia, Ornithology, Herpetology, Ichthyology, Comparative Anatomy, Articulata, Mollusca, and Radiata, for Mineralogy, Geology, Palæontology. This division of labour in the hands of real lovers of the magnificent and beautiful works of the Creator, is the true method of success and progress.

Another feature of this Institute which we deem well worthy of commendation, is that of its field meetings during the favourable seasons of the year. The record of one runs as follows:

"Field Meeting at Topsfield, an exploration of the ponds, streams and woods, such as the extreme heat would permit, having been made by several members in the forenoon, a session was held at 3 o'clock in the Hall of the Academy." Another runs. "Field Meeting at Danvers. A very warm day, ending in a thunder-shower and much rain. The morning was spent in examining the woods, near the residence of Wm. A. Lander, to whose hospitable reception and welcome to his grounds the party were greatly indebted." Why may we not have such meetings in Montreal? We surely do not lack either enthusiasm or scientific knowledge to render them both interesting and profitable? A day spent upon our Mountain by an intelligent band of explorers, such as we might muster, could not fail to be both healthful and profitable. Another on St. Helen's island, or at Isle Jesus, or Belœil, or among our quarries, or fifty other places, would be also delightful. To such excursions many merchants and professional men would we doubt not, be allured from the toils of their daily work. They would be sure to get their bodies refreshed, and their knowledge of places, persons and things greatly enlarged.

Many of these papers contained in the "Proceedings" of the Essex Institute are of much value. They are remarkably well edited. The style in which most of them are written is very pure and good; we say much when we say that it is English of a good type. We might expect this from Massachusetts, and from a city that lies under the literary shadows of Boston. It is so pleasant to find American writings free from national and provincial corruptions that we cannot avoid marking this excellency in these "Proceedings" and appending to it our note of admiration.

The Historical and Scientific lore which the volume contains is considerable. We would especially instance as valuable the Historical paper by S. P. Fowler of Danvers, embracing an elaborate and minute account of the life, character, &c. of the Rev. S. Parris of Salem village, and of his connection with the Witchcraft delusion of 1692. This Biography extends over nineteen closely printed pages, and is of deep interest. It portrays the character of a learned, laborious, and withal sagacious divine. It depicts also the characteristics of the people among whom he lived, and the rise of the curious delusion into which they were drawn by the crafty, the wicked and the credulous.

Another paper, of much botanical interest, was read before the Institute by the Rev. I. Russel, being a review of a book entitled :—

"New England's Varieties Discoverd, in Birds, Fishes, Serpents and Plants of that country. Together with the Physical and Chirurgical Remedies, wherewith the Natives constantly use to cure their Distempers, Wounds and Sores, &c. &c. By John Josselyn, Gent. Second Addition, London, 1675."

The Reviewer's object is, chiefly to identify the plants contained in the list, observed by Josselyn. These are classified (1) into such plants as are common to the two countries, England and America. (2) Such as are peculiar to America, and which had a name. (3) Such as belong to the country, but had no name. With few exceptions the plants described are identified with much interesting criticism and some valuable historical notes. As a specimen of this paper we quote from page 164 :—"Hollow-Leaved Lavender, (*Sarracenia purpurea*). The description of this fine plant, "proper to the country," and really worthy of being one of "New England's Varieties Discovered," is so unique that I shall transcribe it at length.—There is also a very good figure by which the plant in question was easily recognised, "Hollow-Leaved Lavender is a plant that grows in (Salt) Marshes, overgrown with moss,with one straight stalk about the bigness of an oat-straw,better than a cubit high ; upon the top standeth one fantastical flower ; the leaves grow close from the root in shape like a tankard, hollow, tough, and always full of water, the root is made up of many small strings, growing only in the moss and not in the earth ; the whole plant comes to its perfection in *August*, and then it has leaves stalks and flowers, as red as blood excepting the flower, which has some yellow admixt. I wonder where the knowledge of this flower has slept all this while *i. e.* above forty years ?"

"This the purple Side Saddle flower is one of the finest and most ornamental of our native plants, and well known for its singular beauty." "Parkinson's Theatre of Plants," was published in 1640, while John Josselyn Gent's Treatise was published in 1675, (the former contains a good figure and description of this plant,) so that our author seems to have "slept all this while in ignorance of the Hollow-Leaved Lavender, rather than as he supposes others about him had done. The term Lavender is probably expressive of the form of the leaf: *lavo lavendum*, to wash, &c. *Quere*—hence the derivation of pitcher plant, or forefather's pitcher, or Tankard and the like ?"

We would only further refer to a report by a committee of the Institute on the question of "Lightning conducting rods." This

paper we deem of so much practical value that we have transferred t entire to our pages, recommending it to the careful perusal of those of our readers, who are interested in the preservation of ships or houses from injury by lightning.

From this imperfect review of these Proceedings of the Essex Institute, it will be manifest that its labours during the year have been highly fruitful. Its original papers we hesitate not to say, are real contributions to knowledge, and worthy of a place in any scientific library. On reading them we have asked ourself, Why could not Montreal produce something of equal value and interest as this? It is not for the want of men that we do not. Science is represented among us by names of European celebrity, and we have several Amateurs of ability and zeal. There is therefore the material; of this fact no one can doubt—why is it then that we cannot as a Natural History Society occupy a higher place than we do? The reason obviously is that with but one or two honorable exceptions, our Scientific men whom we honor and of whose works we are proud, stand almost entirely aloof from our Society. We have men of liberal education and scientific culture, not a few in our good city, who if they would but associate themselves together to advance the cause of literature and Science would, we are persuaded, do incalculable service to the city and Province. Why should the Canadian Institute of Toronto be better off in this respect than we are? It embraces most, if not all the men of science and literature in the city, and the result is, that its light is shining with ever increasing brightness. If our Natural History Society is not suitable for the reception of our *savans* and *cognoscenti*, let it be reformed, or let a new one be instituted of a kind more suitable to promote the objects of science.

Let not the reproach hang upon us that we are little better than a nominal society. We have now erected a more suitable building for our Museum, Meetings and Lectures. We trust, that this will be the means of attracting many new members and of adding to the ranks of old workers many lovers of Science who will be something more than ornamental members of the time honored Natural History Society of Montreal.

Wild Flowers: how to see and how to gather them. With remarks on the economical and medicinal uses of our native plants. By SPENCER THOMSON, M.D. New edition, revised; with illustrations from designs by Noel Humphreys. London: G. Routledge & Co. Montreal: B. Dawson & Son.

This work is written by one who has a true love of nature and an intimate knowledge of her floral kingdom. Its chief design is to lead the mind to the study of the subject of which it treats in deeper and professedly more scientific works, and to present, in as interesting and comprehensible a form as possible, such a view of the vegetable kingdom as could be illustrated by the plants and flowers of Great Britain. The author has succeeded, we think, in writing a book that will be sure to interest young minds, and amateurs, in the observation of those lovely, and, at the same time, most accessible of God's created works—the wild flowers of the field. He says truly in his preface, and to this we cordially subscribe, "that the time is coming fast when no man or woman will be considered properly educated who is ignorant of the leading facts, at least, of the natural sciences, and when the knowledge and study of these natural revelations from God will rank second only to a knowledge of the higher revelation He has given as of Himself." After an interesting and lively introduction the author, in the *first* part of the book, enumerates and describes the various organs of a plant, their arrangements and development. In part *second* he gives a brief but lucid explanation, amply illustrated, of the Linnæan and Natural systems of classification. Part *third* contains a monthly illustration of British wild flowers, into which are introduced particulars of much interest to those who are entering upon the study of Botany. There are concluding chapters on the flowerless plants and on the economical and medicinal properties of those native to Britain. The book contains one hundred and seventy-one good wood-cut illustrations. It is one of Routledge's cheap series of publications and is an instance of what is doing at the present day by enterprising writers and publishers to bring the highest productions of science and literature within the reach of persons with limited incomes. We cordially recommend this work as one of great merit and deep interest. Its style is remarkably lively and clear and its aim highly commendable.

A Life of Linnæus. By Miss Brightwell, of Norwich. London: John Van Voorst. Montreal: B. Dawson & Son Pp. 191.

This little book gives a most interesting account of the life of the great Swedish Naturalist. It begins with his childhood and youth in the parsonage of Stenbrohult in Smœland, a province in

the south of Sweden, and carries the reader on in the most pleasing manner through the chief incidents that marked the life of Linnæus, to his final eminence. The story is told with great simplicity and elegance. The incidents are skilfully wrought into the narrative. The prominent excellences of this great man's character and genius are lovingly noted. There is no elaborate statement or discussion of his system to perplex young readers; enough, however, is related to excite admiration and awaken interest. The book is besides pervaded with a genuine, unaffected piety, and a true love of nature, which renders it very delightful reading for a winter's evening. To the young we would expressly recommend this Biography. It sets before them an example of perseverance in a chosen pursuit, and shows what may be done by a zealous devotion to any department of study which invites attention. The authoress concludes her pleasing task with a few words recommendatory of the study of Botany. As a mental exercise she particularly commends it, "What study," says she, "is calculated to afford more delightful instruction, at once gratifying a taste for beauty and training the youthful mind to thought and observation. Affording too the most healthful gratification and innocent enjoyment, its pleasures spring up beneath our feet, and as we pursue them, reward us with simple and pure joys." The book is beautifully printed and carefully got up, and will both recompense cost and perusal.

Geological Survey of Canada. Report of Progress for 1857.

As a branch of literature, Geological Reports are in some respects in a pitiable position. Necessarily dry in their details, and to many readers scarcely intelligible, they are too often thrown into dusty corners of libraries, where they lie unread and uncared for. Occasionally they fall into the hands of critics more witty than wise, who can see no advantage in the expenditure of public money in the investigation of fossil remains of shellfish and such trifles; not considering that in thus despising the handiwork of their Maker, they would deprive us of an important aid to the discovery of those deposits of useful minerals in which all men, however little scientific, are interested. In these circumstances it becomes one of the duties of Journals such as this, to point out whatever of utility there may be in these somewhat forbidding documents.

The field-work of the present report belongs to the able assistants whom the head of the Survey has gathered around him, and for the selection of whom he merits all praise. Sir William Logan himself was chiefly employed in arranging the chaotic mass of specimens that had accumulated in the apartments of the Survey, and in securing to Canadian science whatever benefits could be obtained from the meeting of the American Association in Montreal; after which he managed to spend a few weeks in unravelling the tangled skein of those old Laurentian rocks to which of late he has so much devoted himself.

We are surprised that the arrangement of the Museum occupies so small a place in this Report. It has involved an amount of labour appreciable only by those who know the difficulty of arranging large collections. In its present state, the Museum of the Survey may, in its lucid and orderly arrangement, challenge comparison with any similar collection; and affords a systematic exhibition of the geology and of the mineral resources of Canada, which will be read with pleasure by thousands who derive little benefit from printed reports. It would be well in some future Report to give a description and a plan of the Museum, which might also be printed separately as a guide to visitors.

Mr. Murray was occupied with the Huronian formation of the North shore of Georgian Bay, the equivalent of the Cambrian of English geologists, and the chief seat of copper-mining in Canada. His explorations had reference principally to the distribution of a band of limestone, which was taken as a guide mark in tracing out the relations of these crumpled and shattered formations. This limestone has accordingly been traced over a considerable extent of ground, and, with the section which Mr. Murray has made across the country, gives a view of the general arrangement of those rocks which we did not previously possess, and which will materially aid in tracing out the mineral deposits in their continuation in new localities. The writer of this review spent a day or two, two years since, in puzzling over the intricate distribution of rocks and veins at the Bruce Mines, with the aid of the previous reports on the district and would have been thankful then to have had Mr. Murray's map and section for a companion. The general section of the Huronian rocks given by Mr. Murray will be of interest to the geologist, and ought to be in the hands of every one who "prospects" for mines on Lake Huron. It is as follows in ascending order:—

		Feet.
1.	Green altered slates of a chloritic character,	1000
2.	Greenstone,	400
3.	Greenish silicious slates, interstratified with pale greenish quartzite,	1200
4.	Slate conglomerate,	1000
5.	Limestone,	250
6.	Slate conglomerate,	800
7.	Dark blue or blackish fine grained slates, with dark grey quartzite,	500
8.	Whitish or whitish-grey quartzite, passing into quartzose conglomerate with blood-red jasper pebbles,	1000
9.	Greenstone,	700
		6850

The copper veins appear to be confined, at least in their more productive portions, to the greenstone bands. The limestone occurs at the shore near the Bruce Mine, in the rear of the same location, and in a long band extending along the Thessalon River, and thence across Echo Lake and to the north shore of Little Lake George.

Mr. Richardson's work lay in the Peninsula of Gaspé, and had for its object the ascertaining of the precise boundaries of the Lower and Upper Silurian and Devonian rocks, with the view of accurately delineating these in the forthcoming geological map. The details of the coast sections on most parts of this peninsula were very carefully worked out many years ago by Sir William Logan, as we have had occasion to know by following his footsteps, bed by bed, over some parts of the coast. Mr. Richardson had to run lines of section across the country, and trace out the extension inland of the beds seen on the shore. His sections and map accordingly give a very clear idea of the general structure of the fossiliferous rocks of Gaspé. The Gaspé sandstones of Devonian age, which contain the remarkable fossil plants referred to in another page of this number, form a long trough extending through Gaspé Bay, and reaching, with few interruptions, nearly as far as the valley of the Magdalen, a distance of fifty miles. They rest on the great limestone of Cape Gaspé, probably Upper Silurian, and this again is placed unconformably on the edges of sandstones, conglomerate, limestone, and shale, belonging to the Middle and Lower Silurian, which form the long ranges of cliffs extending westward from Cape Rosier. The plant-bearing Gaspé sandstones thus rest on the limestone, exactly

like coal measures on the carboniferous or mountain limestone, and, were it not for the fossils and the relations of the sandstones to the southward, they might easily be mistaken for coal measures. Another portion of Mr. Richardson's Report is occupied with the record of a short reconnaissance of the Silurian limestone which appears at Lake St. John at the head of the Saguenay, accompanied as usual by fertile soil. The occurrence of these rocks here is interesting, as an indication of the recurrence of the fossiliferous formations in an outlying basin in the midst of the great area of Laurentian metamorphic rocks which bound cultivable Canada on the north.

The Palæontology of the Report is wrought out by Mr. Billings and Professor Hall of Albany. As we have already published in this Journal the greater part of both reports, it is unnecessary to refer to them here, except by way of general remark. Prof. Hall's paper on Graptolites is a valuable contribution to palæontology. These curious fossils are very characteristic of certain portions of the Lower Silurian series, and therefore important to geologists in classifying these rocks; but their true nature has been very obscure. The unusually perfect specimens obtained by Sir W. E. Logan have enabled Prof. Hall to represent for the first time their general forms and the arrangement of their parts, though he still expresses a doubt as to their affinities. It seems however almost certain that they were intended to float freely in the sea, bearing along the numerous little animals inhabiting the cells on the sides of their branches, and which were very probably allied to the Bryozoa.

Mr. Billings gives us an elaborate comparison of the fossils of the Black River limestone in Canada with those of the same formation in New York, confirming and extending the fact ascertained by Sir William Logan some time since,—that the fossils of this formation in Canada graduate into those of the Trenton limestone. Mr. Billings has also commenced the study and publication of the fossils of the Devonian series in Western Canada, and describes in this report a number of new species and some new genera of corals and mollusks from these and the Silurian rocks.

We are glad to see so much of the Report occupied with palæontology, and trust that this will be continued and increased. Until the engagement of Mr. Billings, this was the weak point of the Canadian Survey; and as our geological readers very well know, no reliable work can be done in geology without attention to fossils. Obvious though this is, however, we are inclined to

insist on it here; because, while every person knows the value of economical geology, comparatively few are aware of the intimate relation which palæontology bears even to this more utilitarian department. Fossils are in truth the readiest means for identifying rock formations, and are indispensable to any satisfactory comparison of Canadian geology with that of other countries. Does some speculator insist that the Gaspé or the Trenton limestone is the equivalent of the English mountain limestones, and the overlying sandstones and shales coal-measures, a comparison of the fossils at once convicts him of his error. Is a vein of lead-ore discovered in a Canadian formation, and is it important to ascertain if the bed containing it corresponds geologically with those of the lead regions of Missouri or Wisconsin, it may be quite impossible for the geological surveyor to trace its line of outcrop into those regions, but a few fossil shells may settle the point. Does a foreign geologist wish to compare the geology of Canada with that of his own country, he can have confidence in the identification of formations only if their fossils have been carefully and accurately examined. Independently of all this, there is the duty which lies on Canada as a civilized country to contribute her share to the elucidation of the records of creation, in so far as these have been inscribed on her own rocks. She is not asked to pay for explorations to discover a north west passage or explore the Antarctic seas; but it will be a lasting disgrace if she cannot work out the natural history and physical geography of her own territory. Nor must the knowledge of fossils be confined to the officers of the survey and die with them. It must be published and illustrated by good figures, so that, once done, it may remain for future reference, and thus become a permanent addition to the scientific literature of the country. Times may change, and editorials and acts of Parliament may become waste paper; but rocks and fossils are permanent things, and work once well done in reference to them is sure to retain its value. Additions may be made to it, but the substratum will remain good. Nay, it will increase in value; for as a native Canadian literature arises, popular writers will take hold of it; and here, as in England, we shall have pleasant and instructive popular books growing out of what are now dry descriptions and lists of fossils. It may be said that the palæontology of the country would in time be explored and published by amateurs; but this would be an affair of centuries; and in the mean time even the industrial

interests of the country would suffer from lack of this kind of knowledge. There is besides a vast amount of drudgery to be done, which no amateurs will ever undertake, but the execution of which opens up the way for them. The writer has himself worked at some little points of Canadian geology, of which, but for the labours of the Survey, he would perhaps not have known the existence, and from which these labours had already removed the preliminary difficulties. A stimulus is thus given to original investigation by private persons; and there are not yet enough of labourers to occupy the openings already presented. Not to be tedious in this matter, we hope what Sir William Logan is now doing for Canadian paleontology will be appreciated in such a manner as to induce him still more extensively to prosecute this very important department of his work.

Prof. Hunt's portion of the Report is occupied with two distinct subjects;—one, a contribution to the solution of an intricate problem in theoretical geology which has more or less baffled previous enquirers; the other, an enquiry into the value of fish manures and the inducements to their manufacture in Canada. In the first part Mr. Hunt has summed up the principal facts in the history of dolomites or magnesian limestones, and has described with many analyses a great number of there rocks occurring in various formations in Canada. He then considers the theories which have been proposed to explain the formation of these rocks, and rejecting them all as untenable, maintains that the carbonate of magnesia was precipitated mixed with carbonate of lime, and finally united directly with it to form a dolomite. The conditions of this precipitation are illustrated by a series of experiments upon the action of solutions of bi-carbonate of soda on sea-water, and of bi-carbonate of lime upon waters holding sulphate of magnesia. In the latter case by an unexpected reaction there are formed under certain conditions, gypsum and bi-carbonate of magnesia. These researches form a part of a series of investigations in which Mr. Hunt is engaged on the chemical conditions of geological deposition and metamorphism, and which we hope he will one day combine in a systematic treatise on the subject.

Of the second subject, the fish manures, we shall attempt no summary, as the paper itself is reprinted in this number. It should be copied into all the agricultural journals, and extensively circulated. The three facts, that in all the old and run-out soils of Canada, phosphates and ammonia are urgently required; that

these substances are actually worth to the farmer for manure 10 and 20 cents per pound; and that immense quantities of fish garbage, capable of affording these valuable substances, are annually wasted in the fishing districts,—should lead to some practical action in the matter. Some years ago we strongly urged this subject on the attention of the farmers of one of the maritime provinces. A manufactory now exists in Newfoundland; and we hope the time is coming when the culture of wheat may be restored to old farms by the liberal application of this manure.

A new feature in this report is the appearance of Mr. Bell's observations on the living fauna of the Gulf of St. Lawrence. It has often been remarked, in the press and elsewhere, that without much increase of expense the Geological Survey might collect an immense amount of information on the zoology and botany of the province, and more especially on the geographical distribution of its animals and plants. The introduction of the subject in the present report is a small step in this direction, and gives promise of useful work. Mr. Bell is a very young man, the son of the late Rev. Mr. Bell of L'Orignal, himself a geologist, whose collection, very ingeniously arranged, is now in Queen's College. He has in him the material of a good naturalist, and we hope to meet him in many succeeding reports laden with new facts on the distribution of the invertebrates of the Gulf of St. Lawrence.

On the importance of the observations of longitude, by Lieut. Ashe, it is unnecessary to say anything, except that they remind us of the forthcoming map, on which so much of the labour of the survey is at present concentrated. One part of the report, however, is zoological, and relates to certain recent animals of singular habits. "My past experience," says Lieutenant Ashe, "had taught me to avoid the tops of houses, and to select the solid earth and solid rock for the support of my transit instrument. Still I had another lesson to learn. This neighbourhood was infested with boys, who when they saw a light shining through the cracks of the boards, commenced throwing stones with a determination and precision worthy of a better cause; and some of the few clear nights that occurred in this month were lost in consequence of boys' love of mischief. I first tried mild entreaties, and then severe threatenings; they laughed at the former, and made faces at the latter. I then procured the service of the police, who partly succeeded in keeping the boys from further interference with my duties."

This narrative raises the question, which is applicable not only to the Kingston boys but to other assailants of the Survey, whether their ire was excited by the little light which they saw "through the cracks," or by their want of more light on the subject. This is, in some sense, an educational question; and leads to a remark on the circulation of scientific reports, which we think has throughout the United States and British Colonies been greatly mismanaged. Such reports, got up as attractively as possible, should be placed in the hands of the trade, with a fair commission on their sale; and the gratuitous distribution should be limited to public persons and institutions. In this way a much greater and better circulation would be secured, the reports would be more extensively read and appreciated, and would be more accessible to those who really require them, and a large portion of the expense of printing might be saved. This course has been successfully pursued by the Geological Survey of Great Britain. It has also, we are glad to observe, been adopted in the case of the decades of Canadian fossils; and we can scarcely doubt that these will eventually be found even remunerative as a publishing speculation, though the sale may be too slow to enable them to be profitably issued by private enterprise.

J. W. D.

MISCELLANEOUS.

Geological Society of London.—The Meeting of this Society, on the 5th January, was occupied principally with Canadian subjects: a paper, by Principal Dawson, on the "Devonian Plants of Canada," and one by Mr. T. Sterry Hunt, on some points of Chemical Geology.

The paper on Devonian plants related chiefly to the observations made by the writer last summer in Gaspé, which enable him to describe two species of a new genus, to which he gives the name *Psilophyton*. They are lycopodiaceous plants, with many dichotomous branchlets and rudimentary leaves, allied in some respects to the modern genus *Psilotum*, but springing from a horizontal rhizome, similar to that of some ferns, and having the branchlets rolled up circinately in vernation. Plants of this kind in fragments, have been recognized previously in the Devonian rocks of Scotland and the continent of Europe, but were referred to sea-weeds, &c. The Gaspé specimens, for the first time, enable their true

nature and affinities to be made out. Two species, *P. princeps* and *P. robustius*, were described. A fossil conifer, first found in Gaspé by Sir W. E. Logan, was referred to the *Taxineæ*, and described under the name of *Prototaxites Logani*. A lepidodendron (*L. Gaspianum*) and two species of *Knorria*, one not distinguishable from *K. imbricata*, were added to the Devonian flora of Canada; as also a *Noeggerathia*, of which fragments only were obtained. The paper also described the mode of occurrence of the small Devonian coal seam, discovered by Sir W. E. Logan in Gaspé, probably the oldest true coal seam known. The occurrence of impressions of *rain-marks*, sun-cracks, &c., in these beds, was also noticed.

Professor Hunt's paper contained an elaborate exposition of those views of his on the mode of metamorphism of rocks by chemical changes in the presence of water and a moderate amount of heat, which are already in part known to our readers.

We hope, at some future time, to reprint both papers, or abstracts of them, in the *Naturalist*.

Canadian Institute of Toronto.—*New Trilobite.*—In the Number of the Canadian Journal for January, Professor Chapman describes a new Canadian trilobite, and the Hypostoma of his species, described in a former article, the Asaphus Canadensis. The new species is named after the Professor of Natural History in the University of Toronto, *A. Hincksii*. It is distinguished from the other Canadian species of Asaphus, as indicated in the following tabular summary of characters:—

Caudal shield with segment furrows	Head-angles terminating in long points.—*A. Canadensis*.
	Head-angles rounded.—*A. Halli*.
Caudal shield smooth.	Pleuræ curving forwards.—*A. platycephalus*.
	Pleuræ curving backwards.—*A. Hincksii*.
Or:— Pleuræ curving backwards.	Head-angles terminating in horns; pygidium furrowed.—*A. Canadensis*.
	Head-angles slightly rounded; pygidium smooth.—*A. Hincksii*.
Pleuræ curving forwards.	Pygidium furrowed.—*A. Halli*.
	Pygidium smooth.—*A. platycephalus*.

Entozoa.—The same number contains a long article on those remarkable creatures, the internal parasites, that infest man and other animals, by Lucius Oille, M.B. It professes to be mainly a summary of the results of Von Siebold and Kuchenmeister, but is well deserving of the study of medical students and young naturalists. The writer very properly scouts the idea of the *gene-*

ratio equivoca, attributed by old writers to these creatures; but which is so directly contradicted by their enormous reproductive powers and the curious metamorphoses which some of them are known to undergo. He also well maintains their use in nature, as physicians, rough it may be, but necessary to apply sharp remedies to unnatural modes of life. The cestoid entozoa or tape-worms are these of which the history is best known; and they are ascertained to be in their young state the little cystic entozoa that take up their abode in the fl sh and other tissues of animals. What can be more strange than the transformation of the little microscopic entozoon of the liver of a mouse into the tape-worm of the cat, and the eggs of the tape-worm again finding their way into the food of the mouse, and thence into its flesh or liver; or what more curious than that the *Cysticercus cellulosæ*, which causes "measles" in hogs, rabbits, and sheep, is only the young state of the *Tænia solium* which infests the intestines of man, and that man and these domestic animals reciprocally supply each other with these pests.

"The scolex of the tænia solium and the cysticercus cellulosæ are identical. This is apparent from the similarity in anatomical structure and from experiment. It has now been determined beyond controversy that by feeding the hog, rabbit and sheep with the eggs of the tænia solium those animals became infested with the cysticercus cellulosæ, and by feeding the dog and man with those cystic worms, tape-worms were produced in their intestines. The abundance of cysticerci in the hog is well known. Statistics abundantly prove the frequent occurrence of tape-worm in butchers who are accustomed to handle raw meat and are not over careful or cleanly, but often by their hands or knives rubbed in their mouths introduce the cystic worms into their system. It is also common among those who eat in any manner raw or imperfectly cooked meat contaminated with the cysticerci. The Hottentots in the Caffir wars demonstrated the mode of translation of the cystic worms into the suitable nidus for the final stage of development, namely, the intestine. These people in the invasion of the enemy's territory feasted according to their barbarous fashion upon the cattle and sheep that were captured, and became greatly infested with tape-worm, whilst previously they were mostly exempt."

The history of these creatures may be shortly stated as follows:—

1. The *Proglottis* or full-grown joint loaded with ova, passes

from the intestinal canal of the animal infested by tape-worm, and creeps to a little distance, depositing its eggs in grass, in water, &c.

2. The ova being devoured in the food of some animal, are hatched into *Embryos*, microscopic in size, and furnished with little hooks, by means of which they penetrate into the vessels and are carried to different parts of the system.

3. They become developed into the stage of the *resting scolex*, in which they are little sac-like objects, on which heads or scolices armed with hooks and suckers are developed.

4. The flesh of the animal infested by these scolices, now known as *Cysticerci*, is eaten by some carnivorous animal, in whose intestines the little parasites fasten themselves, and become developed into tape-worms, producing new proglottides.

Such are the strange provisions made by a beneficient Creator for the life and welfare of creatures, in themselves most loathsome to us; but like all other parasites and plagues, intended to teach us lessons, both physical and moral, which man has been too slow to learn, and, from neglect of which, both he and his domesticated animals must probably long continue to suffer. The subject is, in many respects, an uninviting one; but of great importance in natural science and hygiene, and, for this reason, we desire to give our mite of encouragement to any one who follows it up in the right spirit.

Agassiz on a Museum of Natural History.—A magnificent scheme, for the promotion of Natural History, is now under consideration in Boston. Prof. Agassiz, having declined the tempting offers made to him by the Emperor of the French, takes advantage of the opportunity to invite the attention of his adopted country to a scheme, by which the capital of Massachusetts may become the centre of Natural History education in America. The plan includes the erection of a museum on a magnificent scale, and the institution of curatorships to be eventually erected into chairs of Natural History. It is wise and far-seeing, and, we hope, will be warmly taken up by the Bostonians, who are alive to the importance of attracting to their city young men desirous of scientific education, and have already been, with this view, munificent patrons of their University. Our little attempts in Canada, in erecting museums and forming provincial and other collections, dwindle into small matters compared with the grand conception of the Swiss naturalist. We quote his own words, in a memorial to the Committee of the Lawrence Scientific School :—

"In its present condition, the museum hardly furnishes me the specimens I require for my courses of instruction, for, in consequence of the daily accessions which are heaped upon those already crowded in this narrow space, it is often impossible to find what is wanted at the time, and it is out of the question to allow free access to the museum in its present confused state, to any student not already trained in the manipulation of specimens. Had I six or eight rooms of the size of the two now at my disposition, I could at least make a fair beginning of a systematic arrangement, separate the duplicates from what is to constitute the collection proper, allow free access to the rooms for the public as well as the students, and thus create a more general interest for this establishment, while the students themselves would derive all the advantages which such a collection ought to afford them in their studies. At the same time, the separation of the duplicates from the collection proper would furnish ample materials for an extensive system of exchanges with other institutions of the same kind, by which the collection would at once be at least doubled in all its parts, and in some of its departments increased three or four times, and in some, even tenfold. The advantages of such a system of exchanges are very obvious, and my inability from want of room to separate the duplicates from the collection, has already been, for some years past, a check upon its increase. I hope, therefore, that as soon as it is fully understood, some remedy for this evil may be found.

"But even the possession of an appropriate building will not altogether put an end to our difficulties. The collection is already so large that it is impossible for me to take charge of it alone, even were I to give all my time to its care. For many years past I have already been under the necessity of having one or two, and at times even three assistants, who, at my private expense, have been, most of the time, engaged in taking care of the specimens. As I have nothing in the world but what I earn daily, such an expenditure has frequently been for me a source of unendurable anxiety, of which I wish to free myself, that I may hereafter devote whatever energy I may possess untrammelled to the higher interests of science. In this perplexity I have thought that a number of curatorships, corresponding to the scholarships now existing in the University, which enable young men, whose private means are insufficient for such an object, to receive a college education, might perhaps be founded by some of our wealthy citizens, which

would furnish a small income to students who have already taken their degree, and who, wishing to prosecute farther their studies under my direction, might thus earn the means of remaining in Cambridge by assisting in the arrangement and preservation of the collection, as well as in making the exchanges. The position of the Curators in the scientific school would thus be similar to that of the tutors in the undergraduate department. In a well-organized museum there should be as many curators as there are branches in zoology, including embryology, palæontology and zoological anthropology. In the course of time, these curatorships (to which should be attached the duty of delivering a certain number of lectures annually) may be endowed so as to afford the means of appointing special professors for each branch, and as soon as this is accomplished, our organization would be more perfect than that of either the British Museum or the Jardin des Plantes. Beside the curators, there should be one or two preparators, to mount specimens, and to make the necessary preparations required for the illustration of the specimens. It would also be desirable to have an artist attached to the establishment who would have to make magnified drawings of such specimens as are too small to be at once studied by the natural powers of the eye; these drawings would be appropriate ornaments for the corridors, and at the same time assist in the courses of lectures which it should be the duty of every curator to deliver annually upon the special branches entrusted to his care.

"Gigantic as this scheme may appear, I see nothing visionary or unpractical in it; for, while it cannot be expected that so many curatorships should be founded at once, it is plain that they are not all needed now, and that the same person may take charge of several departments simultaneously for several years to come, and a subdivision of labor may be introduced as it becomes necessary, and our means make it possible. It would, however, be desirable that the services of four or five curators should be obtained soon, —one to take charge of the vertebrates, one of the mollusks, one of the articulates, one of the radiates, and one for the embryological department; and I would add that the sooner the latter curatorship is permanently founded, the better for our institution, as I believe that the methods I am attempting to introduce in the study of animals by comparing their different stages of growth with the permanent forms of lower types, is likely to be a most original feature in this museum, and that which is likely to secure

for it a place among the institutions which shall contribute largely to the real advancement of science. Let me add, with respect to the lectures to be delivered by the curators, that, while they would be a means of progress for themselves in their studies, they would also learn the difficult art of teaching, and prepare themselves to occupy higher situations in this or other Universi ies.

"While we must wait until the means are secured for founding professorships in the different departments of zoölogy, I believe that it will be easy to enlist the sympathy and co-operation of all the men in the country, who have acquired for themselves a high position as original investigators in the various departments of Zoölogy. Honorary degrees are conferred, all the world over, by learned institutions on men distinguished for their attainments. It would be equally honorable to our university, and to the distinguished naturalists of the country, if it should please the corporation to grant to such men the title of honorary professors of this university. Until we can have a faculty of resident professors, we can at least have one of honorary professors; and I know those who, gratified by such an honorable distinction, would not hesitate to come to Cambridge annually for a short time, and give to our students the benefit of their knowledge, by delivering short courses of lectures in their respective departments."

TWENTY-EIGHTH MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—GEOLOGICAL SECTION.

The Ossiferous Cavern at Brixham.—A paper on this subject was read by Mr. W. Pengelly, but not published in the Athenæum from which our extracts are made. Fortunately W. A. Bovey Esq., Advocate of this city, has a letter from his father, who lives upon the spot in which the following passage occurs, which he has kindly permitted us to copy.

"I must not forget to mention a discovery recently made in our town, resulting from the Commons Inclosure Acts. We sold a portion of Windmill Rea Common, immediately over Mrs. Francis to a Mr. Philp for building purposes. On blowing out the rock for a foundation, they came in upon a cavern; the floor of which consisted principally of calcareous stalagmite, very solid and compact. On exploring it, a very large stag's antler was found imbedded in it, and several bones of the elk, fox, &c. &c.

A party of scientific gentlemen from Torquay subsequently explored it, and obtaining a grant of money from the Geological

Society, (London), they purchased the right of working the cavern from Mr. Philp, for £50. A person from the Isle of Wight has been now engaged in it for a considerable time, and upwards of 2000 specimens of bones of extinct mammalia have been found in the various deposits forming the bed of the cavern. Just imagine such remains, the teeth, jaws, femurs, &c. &c. of the Elephant, Rhinoceros, Hyæna, Bear, &c., being entombed within the mass of lime-rock forming the hill behind the spot over which you have played many a time. When first the cavern was opened, it was not more than from 2 to 3 feet in depth, from the stalactitic roof; but on removing the stalagmite that forms the floor, they found a deep deposit 15 or 16 feet deep. All this has been removed so that the cavern is very large."

The most curious circumstance connected with the exploration of this cavern, is the discovery of flint knives in the bone bed. No human relics ever having been hitherto found mingled with the bones of extinct carnivora. According to the present theory of Geology, or at least, the most generally received notices of Geological time, the human period did not commence until long after the extinction of those mammalia. Nothing has hitherto been found to shew the contemporanity of man with those animals. Hence the discovery of those knives has given rise to much discussion among the Geologists. Some assert that they must have been either placed there by some one on purpose, or have accidently been mingled with those bones by diluvial action &c. &c. Others again contend for a higher period of human antiquity.

After Mr. Pengelly's paper, Prof. Ramsay read a report from the Local Committee at Brixham, from which it appeared that Dr. Falkner had found amongst these ossiferous remains the bones of the rhinoceros, boa, horse, reindeer, cave-bear, and hyæna, and also several well-marked specimens of flint-knives, generally regarded as of Celtic manufacture.

Prof. Owen said he was glad that means had been taken for the frozen together into one contiguous transparent mass, although careful exploration of this cave, but it would be premature to raise any hypothesis until the whole of the parts were before them. He had not yet seen any of the bones, and indeed was entirely indebted for what he knew on the subject to the paper which Mr. Pengelly had read, and he should refrain, therefore, from expressing any opinion, but he wished to caution them against coming to any conclusions as to the antiquity of these remains which were really not warranted. He proceeded to show, from the remains

of tigers, elephants, and other animals found in this country, in Siberia and other parts of the world where the climate was much colder than was supposed to be compatible with their existence. That there was undoubted evidence that these animals could adapt themselves to cold and temperate climates as well as to torrid ones, and remarked that the conditions of animal life were not those of climate, but of food and geniet, wherever there was the prey undisturbed by man, there also would be the destroyer. They had evidence from the writings of Julius Cæsar, of the existence of England, 2000 years ago, of three distinct species of animals, including two gigantic species of ox, and one of the reindeer, and he was himself satisfied that they had once a native British lion, all of which however, were now extinct in this country, and he saw nothing in the remains which had been discovered at Brixham to lead him to suppose that the animals lived before the historic period, or which was inconsistent with the concurrent existence of a rude race of barbarians. At the same time he was open to conviction, and would be very glad to see a good fossil human being, which should prove that man had been much longer upon the earth than historical evidence led them to suppose.

President—W. Hopkins, Esq.

The President said the existence of mammalian life in its earlier stages on the surface of our planet, the condition of its existence, and the period of its introduction, have always furnished ques tions of the highest philosophical as well as palæontological interest. You will be aware that some geologists regard each new discovery of mammalian remains, in formations preceding the older tertiaries, as a fresh indication of the probable existence of mammalia in those earlier periods in which no positive proof of their existence has yet been obtained; while others regard such discoveries only as leading us to an ultimate limit, which will hereafter define a period of the introduction of mammalia on the surface of the earth, long posterior to that of the first introduction of animal life. Be this as it may, every new discovery of the former existence of this highest class of animals must be a matter of great geological interest. An important discovery of this kind has recently been made, principally by the persevering exertions of Mr. Beckles, who has detected in the Purbeck beds a considerable number of the remains of small mammals. The whole of them are, I believe, in the hands of our President, Prof.

Owen, for the determination of their generic and specific characters; but Dr. Falconer seems already to have recognized among them seven or eight distinct genera, some of them marsupial, and others probably placental, of the insectivorous order. I may also notice, as a matter of great paleontological interest, the recent discovery of a new Ossiferous Cave, near Brixham, in Devonshire, of which some account is to be brought before us during this meeting. The past year has been fruitful in paleontological researches.

The subject of the motion of glaciers is one of interest to geologists, for unless we understand the causes of such motion, it will be impossible for us to assign to former glaciers their proper degree of efficiency in the transport of erratic blocks, and to distinguish between the effects of glacial and of floating ice, and those of powerful currents. An important step has recently been made in this subject by the application of a discovery made by Faraday, a few years ago, that if one lump of ice be laid upon another, the contiguous surfaces being sufficiently smooth to insure perfect contact, the two pieces in a short time will become firmly the temperature of the atmosphere in which they are placed be many degrees above the freezing temperature. Dr. Tyndall has the merit of applying this fact to the explanation of certain glacial phenomena. There are two recognized ways in which the motion of a glacier takes place: one by the sliding of the whole glacial mass over the bed of the valley in which it exists; and the other by the whole mass changing its form in consequence of the pressure and tension to which it is subjected. The former mode of progression is that recognized by the sliding theory; the second is that recognized by what has been termed the viscous theory of Prof. Forbes. The viscous theory appeared to be generally recognized. Still, to many persons it seemed difficult to reconcile the property of viscosity with the fragility and apparent inflexibility and inextensibility of ice itself. On the other hand, if this property of viscosity, or something of the kind, were denied, how could we account for the fact of the different fragments, into which a glacier is frequently broken, becoming again united into one continuous mass? Dr. Tyndall has, I conceive, solved the difficulty. Glacial ice, unlike a viscous mass, will bear very little extension. It breaks and cracks suddenly; but the separate pieces when subsequently squeezed together again become by regelation (as it is termed) one continuous mass. After some general re-

marks on the cause of the laminous structure of glaciers, during which he remarked that there was no doubt Dr. Tyndall was right in supposing the laminæ of blue and white ice to be perpendicular to the directions of maximum pressure, he said that it remained to be decided whether the explanations which had been offered were correct; but the actual perpendicularity of the laminæ of ice to the directions of maximum pressure within a glacier, and the probable perpendicularity to those directions of the laminæ in rock masses of laminated structure, would seem to establish some relation between these structures in rocks and glacial ice, giving an interest to this peculiar structure in the latter case, which it might not otherwise appear to possess for one who should regard it merely as a geologist.

SECTION OF ECONOMIC SCIENCE AND STATISTICS.

President—E. BAINES, ESQ.

The President said—If the British Association were a theatre for intellectual display, I should shrink from occupying a chair in which I have had such distinguished predecessors. But if I understand the spirit of this Association, it is the simple, honest, earnest pursuit of truth—first, of truth in facts, and secondly, of truth in principles; and it would be quite foreign to that spirit either to attempt anything of display or to apologize for its absence. I shall be permitted, however, to welcome the disciples of economical and statistical science on their visit to this important centre of industry where practical illustrations may be found of many branches of their subject, and where, I hope, there are many who can value their inquiries. After the remarks made last night by the President of he Association, it may seem superfluous to say anything further on the claims of that science which he pronounced to "bear more immediately than any others on the prosperity of nations and the well-being of mankind." We must all have felt how unanswerably the President proved the value of economical and statistical science, when he referred to the department of vital statistics, and showed what terrific losses had been sustained by our army and navy and the army of France from the neglect of sanitary rules. But I may just remark that what gave to the recent report of Mr. Sidney Herbert's Commission on the health of our troops in barracks its resistless force was, the certainty and precision with which statistical researches enabled it to measure the amount of loss sustained, by comparison with the mortality in other classes of the population at the same

ages. The report might have dwelt on sickness, on injudicious diet, on defective ventilation, on want of drainage, and so forth, and all such statements would have been pronounced to be exaggerations or errors: but when it applied the ascertained scale of mortality, so as to prove that there were so many deaths in the thousand when there ought only to have been half that number, the definiteness of the figures and facts defied evasion, fastened on the public mind and conscience, and compelled immediate measures of reform. Those persons who have ignorantly charged upon political economy and statistics a disregard of moral considerations and of humanity may now see how egregiously they were mistaken, and how the arithmetic which they thought so heartless is rising up as the most powerful advocate of the value of human life, of health, of domestic comfort, of temperance, of virtue, of proper leisure, of education, and of all that can purify and elevate society. I am glad to know that we shall have one or more papers on important points of vital statistics laid before this Meeting. May I for a moment refer to another reproach thrown upon statistics, namely, that they may be so used as to prove anything? I hardly need say that it is unfair to argue from the abuse of a thing against its proper use. But it may be admitted, that there is sufficient ground for this reproach, in the negligent or dishonest use sometimes made of statistics, to call upon us for the exercise of great caution, so that in the first place we may be sure we have got all the facts that are essential, and in the next place that we draw from them sound and accurate conclusions. I cannot refrain from expressing my conviction that as the science we cultivate has been shown to be favourable to humanity, so it is no less favourable to freedom. Within the last quarter of a century how busy has it been in knocking off all sorts of fetters from human energies!

The note on the cover of the December number of the *Naturalist*, in reference to Art. XXX. of our last volume, has, we find, been misunderstood. It was intended merely to remedy an omission of our own. In copying the article in question from the *Canadian Journal*, we omitted to copy with it the acknowledgment to the Smithsonian Institution for the use of the wood-cuts, which were originally prepared for that institution; and also to state that the article was based on that in the report of the Smithsonian Institution for 1856, but brought up to 1858 for the *Canadian Journal*. We regard this more full statement as due to both the bodies to which we have been indebted in this matter.

MONTHLY METEOROLOGICAL REGISTER, SAINT MARTIN'S, ISLE JESUS, CANADA EAST, (NINE MILES WEST OF MONTREAL,) FOR THE MONTH OF OCTOBER, 1858.

Latitude, 45 degrees 32 minutes North. Longitude, 73 degrees 36 minutes West. Height above the level of the Sea, 118 feet.

BY CHARLES SMALLWOOD, M.D., LL.D.

Day of Month.	Barometer, corrected and reduced to 32° F. (English inch.) 6 a.m.	2 p.m.	10 p.m.	Temperature of the Air. °F. 6 a.m.	2 p.m.	10 p.m.	Tension of Aqueous Vapour. 6 a.m.	2 p.m.	10 p.m.	Humidity of the Atmosphere. 6 a.m.	2 p.m.	10 p.m.
1	29.607	29.612	29.791	41.6	62.7	45.9	291	[illegible]	[illegible]	75	73	72
2	.815	.731	.779	36.0	57.2	41.[illegible]	177	[illegible]	[illegible]	55	45	7[illegible]
3	.519	[illegible]	[illegible]	41.2	56.0	48.2	212	[illegible]	[illegible]	82	81	92
4	[illegible]	[illegible]	[illegible]	50.0	57.9	50.4	[illegible]	[illegible]	[illegible]	82	64	7[illegible]
5	.691	[illegible]	.947	41.[illegible]	57.8	38.3	218	179	186	73	40	[illegible]
6	.9[illegible]	.911	[illegible]	[illegible]	57.2	41.0	191	216	197	90	[illegible]	7[illegible]
7	.613	.422	[illegible]	51.2	55.5	[illegible]	149	275	[illegible]	[illegible]	92	96
8	211	21[illegible]	270	57.2	44.6	[illegible]	178	[illegible]	[illegible]	81	75	73
9	257	371	62[illegible]	[illegible]	45.1	[illegible]	223	[illegible]	[illegible]	91	68	79
10	.51[illegible]	.879	[illegible]	40.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	54	53
11	30.047	30.049	[illegible]	34.0	[illegible]	[illegible]	175	[illegible]	[illegible]	89	67	77
12	[illegible]	[illegible]	29.980	31.1	55.8	45.7	149	[illegible]	[illegible]	81	73	92
13	29.[illegible]	29.860	.659	42.7	49.7	[illegible]	257	322	336	87	97	94
14	[illegible]	.57[illegible]	.713	24.0	[illegible]	[illegible]	329	247	[illegible]	95	65	84
15	.756	.908	30.018	42.3	51.7	42.5	211	231	237	91	69	77
16	29.[illegible]	29.[illegible]	270	[illegible]	[illegible]	[illegible]	142	245	[illegible]	84	65	91
17	[illegible]	[illegible]	[illegible]	49.2	[illegible]	[illegible]	210	291	[illegible]	[illegible]	85	[illegible]
18	[illegible]	[illegible]	.050	35.8	50.6	[illegible]	137	182	[illegible]	95	66	90
19	[illegible]	[illegible]	.017	47.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	62	55
20	[illegible]	[illegible]	[illegible]	52.0	[illegible]	[illegible]	228	[illegible]	[illegible]	[illegible]	[illegible]	7
21	.2[illegible]2	.121	[illegible]	37.0	56.0	[illegible]	300	[illegible]	[illegible]	[illegible]	[illegible]	83
22	.001	29.[illegible]	29.[illegible]	47.7	52.0	[illegible]	265	232	[illegible]	92	[illegible]	92
23	29.842	.863	[illegible]	42.7	54.0	45.2	214	[illegible]	[illegible]	91	81	92
24	.752	[illegible]	30.121	41.0	[illegible]	37.0	231	[illegible]	[illegible]	95	65	81
25	30.203	30.200	.212	30.3	45.0	[illegible]	136	[illegible]	161	[illegible]	47	96
26	.231	.214	[illegible]	24.2	[illegible]	[illegible]	111	239	170	[illegible]	7	[illegible]
27	[illegible]	.154	.146	29.0	[illegible]	41.5	147	[illegible]	325	94	[illegible]	91
28	[illegible]	[illegible]	[illegible]	52.0	[illegible]	[illegible]	[illegible]	[illegible]	162	95	[illegible]	84
29	[illegible]	[illegible]	29.994	[illegible]	[illegible]	44.7	157	[illegible]	[illegible]	94	87	90
30	29.8[illegible]	29.712	[illegible]	41.6	[illegible]	[illegible]	211	156	329	95	53	96
31	[illegible]	[illegible]	[illegible]	47.9	[illegible]	47.0	510	282	292	94	58	73

Day of Month.	Direction of Wind. 6 a.m.	2 p.m.	10 p.m.	Mean Velocity in Miles per hour. 6 a.m.	2 p.m.	10 p.m.	Amo'nt of Rain in inches.	Amo'nt of Snow in inches.	Weather, Clouds, Remarks, &c., &c. [A cloudy sky is represented by 10, a cloudless one by 0.] 6 a.m.	2 p.m.	10 p.m.
1	N. [illegible]	N. E. by E.	N. W. by N.	[illegible]	11.72	5.70			C. Str. 9.	C. Str. 10.	C. Str. 4.
2	N. [illegible]	W. S. [illegible]	S. [illegible]	[illegible]	11.45	1.06			Clear.	Clear.	Clear.
3	E. [illegible] E.	S. E.	S. E.	[illegible]	[illegible]	0.22	0.200		C. Str. 10.		C. Str. 10.
4	W. S. W.	W.	W	12.5[illegible]	22.2	11.06			" 6.	C. Str. 9.	Str. 4.
5	W. S. W.	W.	W. [illegible]	[illegible]	18.31	9.10			Clear.	Clear.	Clear.
6	W. S. [illegible]	W. S. W.	W. S. W.	[illegible]	[illegible]	[illegible]			"	"	"
7	E. N. E.	N. E. by E. S.	[illegible]	0.59	2.08	3.40	0.770		Str. 8.	Rain.	Rain.
8	S. W. by W.	W. S. W.	S. W. by S.	10.96	15.67	[illegible]	0.17[illegible]		C. Str. 10.	C. Str. 6.	C. Str. 6.
9	S. W. E.	W. W. by N.	W.	8.71	27.44	[illegible]	0.4[illegible]		Rain.	" 10.	" 6.
10	W.	W.	W. S. W.	11.05	13.[illegible]	1.81			C. Str. 2.	" 14.	Clear. Aurora Borealis.
11	N. W.	S. W.	S. E. by E.	0.21	1.11	[illegible]			C. C. Str. [illegible]	Clear.	C. Str. 10.
12	E. [illegible]	E. N. E.	S. E. by E.	4.47	4.25	1.77			Clear.	C. C. Str. 4.	C. Str. 6. Aur. Bor.
13	S. [illegible]	S. E. by E.	S. S. E.	0.09	12.95	6.77	1.090		Rain.	Rain.	" 10.
14	W.	S. W. by S.	S. S. W.	7.80	9.05	0.75	0.103		C. Str. 10.	C. St. 8.	Clear.
15	W. [illegible] S.	W.	W.	3.07	2.32	14.26			C. C. Str. 6.	" 6.	C. Str. 4.
16	[illegible] W.	[illegible] by W.	S. E.	2.27	0.44	0.00			Clear.	C. C. Str. [illegible]	" 6.
17	N. [illegible] by E.	[illegible] E. by E.	N. N. E.	2.27	5.71	[illegible]	1.[illegible]		C. Str. 7.	C. Str. 6.	C. C. Str. 6.
18	S.	[illegible] W.	S. S. W.	[illegible]	0.73	4.22			Fog.	" 8.	Clear. Aurora Borealis.
19	S. [illegible]	[illegible] S. E.	W. S. W.	[illegible]	1.10	2.22			Clear.	" [illegible]	Cirr. Cum. 4.
20	W.	[illegible] S. E.	E. S. E.	0.12	3.71	[illegible]			C. Str. 2.	C. Str. 6.	Clear.
21	[illegible]	[illegible] N. E.	E. N. E.	5.75	[illegible]	[illegible]			Clear.	Clear.	"
22	[illegible]	[illegible] E.	W.	[illegible]	5.81	[illegible]	Inapp.		C. Str. 10.	C. Str. 2.	C. Str. 10.
23	[illegible] E.	N. [illegible]	N. by E.	[illegible]	[illegible]	10.90	Inapp.		" 6.	" 10.	Rain.
24	N. [illegible] by E.	[illegible] E. by E.	N. E. by E.	2.[illegible]	12.09	[illegible]	2.[illegible]		Rain.	" 4.	Clear.
25	N. E. by E.	E. N. E.	N. E. by E.	9.92	[illegible]	2.57			Clear.	" 2.	Clear.
26	N. E.	S. W. by S.	S. W. by S.	0.16	1.22	0.00			Str. 2.	Str. 5.	Clear.
27	W.	W.	W.	0.34	0.10	0.11			Clear.	Clear.	Clear. Aurora Borealis
28	W. by S.	N. E. by E.	E. S. E.	0.00	5.09	0.73			Light Cirri.	"	Clear. Aurora Borealis.
29	N. E. by E.	E. N. E.	S. E. by S.	7.[illegible]	6.00	4.01	0.[illegible]		Str. 4.	C. Str. 6.	Rain.
30	S. S. E.	S. E. by S.	N. E.	4.40	[illegible]	0.11	0.103		C. Str 6.	" 8.	C. Str. 8.
31	S. W.	W. by S.	N. E. by E.	0.73	[illegible]	1.52			" 10.	C. C. Str. 5.	" 10.

REPORT FOR THE MONTH OF NOVEMBER, 1858.

	6 a.m.	2 p.m.	10 p.m.	6 a.m.	2 p.m.	10 p.m.	6 a.m.	2 p.m.	10 p.m.	6 a.m.	2 p.m.	10 p.m.
1	29.963	30.125	30.250	44.1	45.8	[illegible]	282	182	157	96	61	71
2	30.305	.274	.261	[illegible]	43.1	34.0	137	171	155	74	62	79
3	.231	.116	29.924	21.0	40.1	[illegible]	112	[illegible]	138	83	58	81
4	29.871	29.654	.932	36.1	36.1	35.2	206	191	183	98	90	90
5	.909	[illegible]	.887	34.0	45.0	41.0	162	248	213	[illegible]	[illegible]	57
6	.845	.825	.651	36.0	40.0	36.8	131	190	170	90	74	80
7	.679	.520	.600	33.5	35.6	42.7	175	183	173	94	93	94
8	.750	.407	.720	32.5	30.5	20.6	173	113	171	[illegible]	60	94
9	.74[illegible]	[illegible]	.770	33.0	38.9	31.9	176	[illegible]	[illegible]	95	52	81
10	.761	.711	.921	27.4	31.7	21.5	125	[illegible]	111	87	73	86
11	29.004	30.002	30.007	21.8	27.0	25.1	085	[illegible]	094	78	80	[illegible]
12	29.970	29.812	29.927	19.1	32.2	27.4	077	[illegible]	117	76	74	7
13	.871	[illegible]	.523	[illegible]	29.7	30.0	128	142	148	87	87	80
14	.792	.771	.820	13.3	31.7	16.0	057	140	074	72	[illegible]	[illegible]
15	.792	.700	.691	6.0	27.0	18.6	043	101	077	[illegible]	74	[illegible]
16	.415	.450	.712	16.0	[illegible]	25.1	074	117	117	82	80	86
17	.517	.507	.714	[illegible]	50.0	[illegible]	106	142	128	[illegible]	84	77
18	[illegible]	.511	.670	[illegible]	[illegible]	[illegible]	118	[illegible]	101	84	73	91
19	.657	[illegible]	.872	23.5	21.4	[illegible]	117	058	071	82	70	70
20	.852	.727	.801	19.2	[illegible]	[illegible]	077	107	[illegible]	71	[illegible]	[illegible]
21	.777	.761	.782	22.4	27.4	26.2	085	[illegible]	[illegible]	79	[illegible]	57
22	[illegible]	[illegible]	[illegible]	13.1	37.2	23.6	072	162	[illegible]	[illegible]	[illegible]	[illegible]
23	.681	[illegible]	[illegible]	20.1	27.0	26.2	[illegible]	[illegible]	[illegible]	79	[illegible]	[illegible]
24	.567	[illegible]	.627	27.2	[illegible]	22.3	120	[illegible]	[illegible]	[illegible]	73	[illegible]
25	.681	[illegible]	.716	19.1	[illegible]	[illegible]	087	[illegible]	128	84	[illegible]	[illegible]
26	.761	[illegible]	.914	26.0	[illegible]	26.7	128	117	117	[illegible]	[illegible]	[illegible]
27	.952	[illegible]	.902	27.1	30.0	28.2	111	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	.670	.681	[illegible]	[illegible]	29.2	21.9	088	133	088	78	77	[illegible]
29	.614	[illegible]	.677	18.1	26.2	[illegible]	[illegible]	111	085	[illegible]	80	78
30	[illegible]	[illegible]	.914	[illegible]	29.0	12.0	077	128	051	96	77	71

	6 a.m.	2 p.m.	10 p.m.	6 a.m.	2 p.m.	10 p.m.			6 a.m.	2 p.m.	10 p.m.
1	N. E. by E.	N. E. by E.	N. N. E.	[illegible]	6.72	6.81	Inapp.		C. Str. 10.	C. Str. 2.	Str. 2.
2	N. E. by E.	N. E. by E.	N. E. by F.	3.25	8.27	6.56			Clear.	Light Cirri. 2.	Clear.
3	N. E. by E.	N. E. by E.	N. E. by E.	8.27	[illegible]	[illegible]			"	C. Str. 4.	C. Str. 6.
4	N. E. by E.	E. S. E.	N. E. by E.	9.09	[illegible]	2.83	0.540	Inapp.	C. Str. 10.	Sleet, snow.	Rain.
5	S. E. by E.	W. by N.	N. N. W.	0.47	2.00	0.22			" 10.	C. Str. 10.	C. Str. 10.
6	N. N. E.	N. E. by E.	N. E. by E.	2.50	8.75	12.20	Inapp.		" 9.	" 9.	" 10.
7	S. E. by E.	S. E. by E.	S. N. W.	18.13	7.57	1.06	2.550	0.10	Rain.	Rain.	Sleet.
8	W. S. W.	S.	W. N. W.	0.00	1.40	5.40	Inapp.		C. Str 10.	C. Str. 10.	Str. 4.
9	W. by N.	S.	S.	[illegible]	0.00	0.00			" 9.	" 8.	C. Str. 10.
10	N. N. E.	W. N. W.	W. N. W.	2.26	6.78	9.96		0.40	" 10.	" 9.	" 9.
11	W. N. W.	W. S. W.	S. W.	17.62	[illegible]	[illegible]			" 8.	" 10.	" 10.
12	E. by S.	S. E.	S. E.	0.02	0.02	0.22			" 8.	" 4.	C. Str. 2.
13	E. N. E.	S. S. E.	E.	1.73	7.47	2.19		2.55	" 10.	Snow.	Snow.
14	W.	W. by N.	N. W	[illegible]	[illegible]	8.62		0.70	Clear.	C. Str. 4.	Clear.
15	W. S. W.	W.	W. by N.	1.90	1.19	[illegible]			C. Str. 10.	" 8.	Clear.
16	W.	N. E.	N. N. E.	[illegible]	16.00	1.14		Inapp.	" 8.	Snow	C. Str. 10.
17	N. W.	W.	W.	[illegible]	25.02	12.20			" 8.	C. Str. 6.	Clear.
18	W. S. W.	W. S. W.	W. S. W.	7.01	11.13	[illegible]			" 10.	" 6.	C. Str. 8.
19	W. N. W.	W. N. W.	W.	[illegible]	22.22	11.12		Inapp.	" 7.	" 10.	C. Str. 2. Lunar Halo.
20	W	W. S. W.	W. S. W.	9.75	3.01	[illegible]			" 6.	" 6.	Clear.
21	S. E.	S. E.	N. E. by E.	0.01	0.00	0.35			Cirr. 2.	Clear.	C. Str. 2.
22	S. by E.	E.	E. N. E.	0.07	0.42	1.33			C. Str. [illegible]	C. Str. 10.	" 9.
23	N. E. by E	N. E. by E	N. E. by E.	[illegible]	[illegible]	9.61		0.30	Snow.	Snow.	" 10.
24	N. E. by E.	N.	W. by N.	[illegible]	[illegible]	0.12		0.36	C. Str. 1.	C. Str. 2.	" 10.
25	W.	W. N. W.	W. S. W.	11.10	[illegible]	10.50			" 10.	" 10.	" 10.
26	W.	W. N. W.	W. N. W.	7.70	[illegible]	[illegible]			" 9.	" 10.	" 9.
27	W. N. W.	S. W.	S. W.	[illegible]	3.45	2.70			" 9.	" 10.	" 9.
28	W.	S. S. W.	S. E. by S.	[illegible]	[illegible]	[illegible]			C. C. Str. 8.	" 6.	" 8.
29	N. E. by E.	S. E.	S. by W.	1.12	1.77	[illegible]			C. Str. 8.	" 10.	" 8.
30	S. E. by S.	W.	W. N. W.	1.29	5.95	[illegible]		[illegible]	C. Str. 10.	" 6.	Clear.

REMARKS FOR OCTOBER, 1858.

Barometer { Highest, the 18th day, 30.213 inches. Lowest, " 8th " 29.211 " Monthly Mean, 29.9[illegible]2 inches. Monthly Range, 1.00[illegible] " }

Thermometer { Highest, the 1st day, 70°.6. Lowest, the 26th day, 24°.2. Monthly Mean, 46°.48. Monthly Range, 46°.4. }

Greatest intensity of the Sun's rays, 81°.1.
Lowest point of terrestrial radiation, 24°.4.
Mean of humidity, 0.792.
Amount of Evaporation in inches, 1.670.

Rain fell on 12 days, amounting to 5.620 inches; it was raining 53 hours and 10 minutes, and was accompanied by thunder and lightning on 2 days.

Most prevalent wind, N. E. by E. Least prevalent wind, S.

Most windy day, the 24th day; mean miles per hour, 16.48.

Least windy day, the 1st day; mean miles per hour, 2.00.

Aurora Borealis visible on 5 nights.

Comet visible to the naked eye till the 14th day.

The Electrical state of the atmosphere has indicated moderate intensity.

Ozone was present in large quantity.

Snow Birds (*Plectrophanes nivalis*) first seen on 26th day.

REMARKS FOR DECEMBER, 1858.

Barometer. { Highest, the 2nd day, 30.305 inches. Lowest, " 16th " 29.419 " Monthly Mean, 29.779 inches. Monthly Range, .886 " }

Thermometer. { Highest, the 1st day, 46°.2. Lowest, " 15th " 4°.8. Monthly Mean, 26°.78. Monthly Range, 41°.4. }

Greatest intensity of the Sun's rays, 58°.9.
Lowest point of terrestrial radiation, 4°.8.
Rain fell on 6 days, amounting to 3.090 inches; it was raining 31 hours and 9 minutes.

Mean of humidity, .809.

Snow fell on 10 days, amounting to 6.41 inches; it was snowing 36 hours and 35 minutes.

First Snow of the season fell on the 4th day.

Most prevalent wind, N. E. by E. Least prevalent wind, E.

Most windy day, the 17th day; mean miles per hour, 22.249.

Least windy day, the 21st day; mean miles per hour, 0.11.

Lunar Halo visible on 1 night.

The Electrical state of the atmosphere has indicated moderate intensity.

Ozone was present in large quantity.

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Article V.—*On the cold term of January*, 1859, *from observations taken at St. Martin, Isle Jésus, C. E., Lat.* 45° 32′ *N., Long.* 73° 36′ *W.*, 118 *feet above the level of the Sea.* By Charles Smallwood, M.D., LL D., Professor of Meteorology in the University of McGill College, Montreal.

(Presented to the Natural History Society of Montreal.)

The unprecedented cold term of January, 1859, has induced me to place on record the principal atmospheric phenomena with which it was accompanied. Its advent possessed some peculiar features, not common to the normal or usual cold terms of this climate. It is much to be regretted that we possess no regular and extended system of meteorological observations, upon which we can found conclusions as to the centre or turning point of the storm. All that we know at the present is, that its course was eastward, and that its duration and intensity were remarkable.

The weather at the beginning of January, was somewhat mild, the mean temperature of the 1st day, was 30°9 F. The thermometer fell on the morning of the 3rd to—4°, and was followed on the 4th day by slight snow. The wind was from the N. E. by E. with a mean velocity of, from 9·18 to 4·17 miles per hour. The barometer on the 3rd indicated 30·416 inches. The wind, at noon on the 5th, veered by the South to S. by E., and the barometer fell to 29·621 inches. At 3 a m., on the 6th it veered to the S. W. with a rising barometer. The

mean of the temperature on the 5th was 34°6, and on the 6th 27°3. At sunrise on the 7th day, the wind veered to N. E. by E. with a decrease in the barometric column; the lowest temperature recorded was 17°1 and the highest 36°7; snow commence to fall at 1 a.m., and ceased at 3·15 p.m., and indicated a fall of 2·16 inches; rain then set in and continued to fall till 10 p.m., and amounted to 0·021 inches; the wind veered at 10 p.m. by the North to W. by S.; the mean velocity attained during the night was 36·22 miles per hour and very squally; heavy *cumulo-strati* clouds were passing and occasional slight precipitation of snow took place in the shape of slight snow-showers during the night, and until day break, and at 3 a.m. On Saturday the 8th day the thermometer indicated 0· (zero), barometer 29·576 wind, W. by S., and varying from 13·22 to 18·33 miles per hour. The thermometer continued falling and attained a record of temperature, I believe unequalled in Canada, both as to its intensity and its duration. The following table indicates the temperature:

Saturday, 8th	January, 1859,	3 a.m.		0°0	F.
"	"	6 a.m.	—	4°1	(Below zero.)
"	"	7 a.m.	—	3°7	"
"	"	Noon.	—	2°9	"
"	"	2 p.m.	—	1°9	"
"	"	9 p.m.	—	13°0	"
"	"	10 p.m.	—	13°6	"
"	"	Midnight	—	16°4	"
Sunday, 9th	"	6 a.m.	—	29°9	"
"	"	7 a.m.	—	29°0	"
"	"	9 a.m.	—	28°4	"
"	"	Noon.	—	23°8	"
"	"	2 p.m.	—	21°5	"
"	"	9 p.m.	—	33°9	"
"	"	10 p.m.	—	34°2	"
"	"	Midnight	—	36°0	"
Monday 10th	"	6 a.m.	—	43°6	"
"	"	7 a.m.	—	43°1	"
"	"	9 a.m.	—	41°6	"
"	"	Noon.	—	20°1	"
"	"	2 p.m.	—	14°3	"
"	"	9 p.m.	—	28°8	"
"	"	10 p.m.	—	29°2	"
"	"	Midnight	—	31°6	"
Tuesday 11th	"	6 a.m.	—	37°1	"
"	"	7 a.m.	—	36°9	"
"	"	Noon.	—	24°8	"

Tuesday, 11th January, 1859,		2 p.m.	—	19°9	"
"	"	9 p.m.	—	21°0	"
"	"	10 p.m.	—	21°6	"
"	"	Midnight	—	18°1	"
Wednesday 12th	"	6 a.m.	—	19°4	"
"	"	2 p.m.	—	10°4	"
"	"	10 p.m.	—	5°0	"
Thursday 13th	"	6 a.m.	—	3°1	"
"	"	7·30 a.m.		0°0 (Zero.)	

This table shows a period of 124 hours 30 minutes during which the temperature was below zero—mercury froze in open vessels; but the column of mercury in the tube of the thermometer did not cease to contract at the lowest temperature—43°6 (below zero); and Dr. Kane in his arctic voyages mentions the fact that the mercurial column descended as low as—44° ; and Sir E. Belcher is said to have observed the mercurial thermometer as low as—46°. The mean temperature of Sunday the 9th, was —27°8; and of Monday the 10th—29°0; and of Tuesday—28°2 The barometer attained at 10 p.m. on Sunday the 9th the unusual height of 30·614 inches, the mean velocity of the wind during the day which was from the E. N. E. was 8·89 miles per hour.

On the 10th the wind was from the S.W. by S., mean velocity 0·08 miles per hour. The Aurora Borealis was visible on the nights of Sunday, Monday and Tuesday, but not attended with any great display.

The cold term ended by a fall of snow which commenced at 9·45 p.m. on the 12th, and ceased at 6·10 a.m. on the 13th day, and amounted to 1·10 inches in depth.

This cold term was felt generally throughout Canada and the Eastern States, and seems to have travelled from the west, eastward. At Rochester the extreme cold was felt some hours earlier than at this place, which is 4°15′ west of this observatory, and 398 feet higher above the Sea-level, there—10° below zero was the minimum temperature. At Brooklyn near New-York, it was —9°, and is the lowest temperature recorded there for the last 70 years. At Boston it reached —14°, at Toronto —38°, at Quebec —40°1, at Huntingdon about 60 miles south of this place the mercurial thermometer indicated —44°, and mercury is said to have been frozen quite hard in 15 minutes when exposed in a saucer.

The *Ozonometer* indicated during the excessive cold but a moderate degree, varying from 3 to 5 of Schonbein's scale.

The electrical state of the atmosphere, indicated *positive* signs,

and its mean intensity during the cold term was about 5° degrees of intensity in term of Voltas' Electrometer, No. 1.

The indications of the *Psychrometer* at these low temperatures, appears somewhat remarkable and perhaps defective, the *Ice coated Bulb*, indicated at the lowest temperature a little more than a degree higher then the *dry bulb*, and this continued so with a *decreasing temperature*, but as the temperature gradually rose the *ice coated bulb* indicated as usual a lower temperature then the *dry bulb*,—which would lead to the supposition that at these extreme cold points, the ice formed rather a sheath or covering over the bulb and prevented the uniform and gradual contractions for decrease of temperature consequent on evaporation in the mercurial column, corresponding to the *dry bulb*, and it was also observed that the *ice coated bulb* was not so easily affected by slight increase of temperature as generally takes place at more moderate indications.

I have not seen the fact noticed, and would call the attention of observers to this point, but these remarks are only applicable to the extreme cold temperatures above noticed, and of which we have had hitherto so few examples.

St. Martin, Isle Jésus, C. E.,
March 1, 1859.

ARTICLE VI.—*Report on the Fisheries of the Gulf of Saint Lawrence.* By H. M. Perley, Esq., Her Majesty's Emigration Officer at Saint John, N.B.

(*Continued from our last.*)

THE MACKEREL.

The common Mackerel (*Scomber scombrus*) abounds in the Gulf of St Lawrence, and is one of the chief objects of pursuit with the numerous fleets of American fishing vessels, which are to be found yearly in every part of the Gulf. The Americans begin fishing for Mackerel, in the Gulf, on the first of July, and finish at the end of September; but the resident fisherman might begin this fishing earlier, and continue it until the very close of the season.

Mr. MacGregor describes the Mackerel of the Gulf as being of much finer flavour than those caught on the shores of Europe.

It has been generally supposed that the Mackerel was a fish of passage, performing certain periodical migrations—making long

voyages from south to north at one season of the year, and the reverse at another; but the error of this opinion is now generally admitted. It is known with certainty, that Mackerel remain near the coast of England at all times, as they have been taken there in every month of the year. Mr. Yarrell, whose work on British Fishes is of the highest authority, is of opinion that the Mackerel is not a migratory fish; he says—" The law of nature which obliges Mackerel and others to visit the shallow waters of the shores at a particular season, appears to be one of those wise and bountiful provisions of the Creator, by which not only is the species perpetuated with the greatest certainty, but a large portion of the parent animals are thus brought within the reach of man; who, but for the action of this law, would be deprived of many of those species most valuable to him as food. For, the Mackerel, dispersed over the immense surface of the deep, no effective fishery could be carried on; but approaching the shore as they do, from all directions, and roving along the coast in immense shoals, millions are caught, which yet form but a very small portion compared with the myriads that escape."

Although Mackerel are found in vast shoals along the whole eastern coast of New Brunswick, and within the Bay of Chaleur, yet the quantity taken by resident fisherman is so very limited, as not to furnish a sufficient supply for home consumption, and few indeed for export.

The Ports of the Province within the Gulf, exported the undermentioned quantities of Mackerel, in barrels, during the last eight years:—

PORTS.	1841	1842	1843	1844	1845	1846	1847	1848	Total.
Dalhousie, ...	..	..	..	..	..	..	..	..	..
Bathurst, ...	..	..	..	..	..	33	..	4	37
Caraquette, ...	..	..	..	..	..	256	99	25	380
Miramichi, ...	..	..	..	..	..	145	47	..	192
Richibucto, ...	..	..	..	..	..	..	..	..	..
Totals,	..	..	..	..	..	434	146	29	609

This is a most "beggarly account" of a fishery which ought to be, in this Province, one of the most extensive and most lucrative. The export of 29 barrels only in the year 1848 is perfectly surprising, when it is considered that the season was one in which the Mackerel fishery was more than usually successful. In Au-

gust last, the waters of the Strait of Northumberland, from Shediac to Prince Edward Island, were perfectly alive with Mackerel. Off Point Escuminac, the American fisherman caught them with such rapidity, and in such quantities, that they were unable to clean and salt the fish as fast as they were caught; and it was reported on the coast, that they had sent on shore, and engaged some of the settlers at high wages, to go off to the vessels, and assist in these necessary operations.

Monsieur Leon Robicheaux an intelligent native fisherman, resident on Shippagan Island, from whom the writer obtained valuable information as to the Fisheries, stated, that although Mackerel were always plentiful during the season near Shippagan and Miscou, yet the resident fishermen were too idle to take them. He added, that they only caught a few as bait for Cod, or as matter of sport, when sailing to or from their stations for Cod fishing.

The American vessels which prosecute Mackerel fishing near the shores of New Brunswick, are fitted out in Maine and Massachusetts; they have two long voyages to make in going to, and returning from, their fishing ground, yet they find it profitable. If it be profitable to them, how much more so could it be made by resident fishermen, who are spared the expense of costly vessels and outfits, high wages, and long voyages.

The mode of fishing pursued by the American Mackerel Fishers who frequent the Gulf, is that with the line, called "trailing." When a "schull" is met with, the vessel, generally of 60 or 80 tons burthen, is put under easy sail, a smart breeze (thence called a Mackerel breeze) being considered most favourable. It is stated by Mr. Sabine, of Easport—who is good authority,—that he has known a crew of ten men, when fishing in the Bay of Chaleur, catch in one day, ninety packed or "dressed" barrels of Mackerel, which could not contain less than 12,000 fish.

If no fish are in sight, the American Mackerel Fisher on reaching some old resort, furls all the sails of his vessel, except the main sail, brings his "craft" to the wind, and commences throwing over bait, to attract the fish to the surface of the water. The bait is usually small Mackerel, or salted Herrings, cut in pieces by a machine, called a "bait-mill." This consists of an oblong wooden box, standing on one end, containing a roller armed with knives, which is turned by a crank on the outside; it cuts up bait very expeditiously. If the fisherman succeeds, the Mackerel then seem willing to show how fast they can be caught; and the fishing goes

on till the approach of night, or the sudden disappearance of the remnant of the "schull" puts an end to it. The fish are then dressed, and thrown into casks of water to rid them of blood. To ensure sound and sweet Mackerel, it is indispensable that the blood and impurities should be thoroughly removed before salting; that the salt should be of the best quality, free from lime, or other injurious substances; and that the barrels should, in all cases, be tight enough to retain the pickle.

In those Harbours of Nova Scotia which are within the Strait of Canso, Mackerel of late years, have been taken in seines, capable of enclosing and securing 800 barrels; and in these seines, 400 and even 600 barrels have been taken at a single sweep. The "drift-net" is also used; but as it is believed that this mode of fishing is not so well understood on the coast of Nova Scotia, as on that of England, the manner of fishing near the latter, with the "drift net," as described by Mr. Yarrel, is given in preference:—

"The most common mode of fishing for Mackerel, and the way in which the greatest numbers are taken, is by drift-nets. The drift-net is 20 feet deep, by 120 feet long; well corked at the top. but without lead at the bottom. They are made of small fine twine, which is tanned of a reddish-brown colour, to preserve it from the action of the salt water, and it is thereby rendered much more durable. The size of the mesh is about 2½ inches, or rather larger. Twelve, fifteen, and sometimes eighteen of these nets are attached lengthways, by tying along a thick rope, called the drift-rope, and the ends of each net, to each other. When arranged for depositing in the sea, a large buoy attached to the end of the drift-rope is thrown overboard, the vessel is put before the wind, and as she sails along, the rope with the nets thus attached, is passed over the stern into the water, till the whole of the nets are thus thrown out. The nets thus deposited, hang suspended in the water perpendicularly, 20 feet deep from the drift-rope, and extending from three quarters of a mile to a mile, or even a mile and a half, depending on the number of nets belonging to the party, or company engaged in fishing together. When the whole of the nets are thus handed out, the drift-rope is shifted from the stern to the bow of the vessel, and she rides by it as at anchor. The benefit gained by the boats hanging at the end of the drift-rope is, that the net is kept strained in a straight line, which, without this pull upon it would not be the case. The nets are "shot" in the evening, and sometimes hauled once during the night, at others allowed to re-

main in the water all night. The fish roving in the dark through the water, hang in the meshes of the net, which are large enough to admit them beyond the gill-covers and pectoral fins, but not large enough to allow the thickest part of the body to pass through. In the morning early, preparations are made for hauling the nets. A capstan on the deck is manned, about which two turns of the drift-rope are taken; one man stands forward to untie the upper edge of each net from the drift-rope, which is called casting off the lashings; others hand the net in with the fish caught, to which one side of the vessel is devoted; the other side is occupied with the drift-rope, which is wound in by the men at the capstan."

The following is a statement of the number of barrels of Mackerel inspected in Massachusetts in each year, from 1831 to 1848, inclusive:—

1831,........	383,559	1840,........	50,992
1832,........	212,452	1841,........	55,537
1833,........	212,946	1842,........	75,543
1834,........	252,884	1843,........	64,451
1835,........	194,450	1844,........	86,180
1836,........	176,931	1845,........	202,303
1837,........	138,157	1846,........	174,064
1838,........	108,538	1847,........	232,581
1839,........	73,018	1848,........	300,130

It does not appear what proportions of these large quantities of Mackerel were caught in British waters; but it must have been a very considerable share, if an opinion may be formed from the numerous fishing vessels of Massachusetts seen on the coast of Nova Scotia, and within the Gulf of Saint Lawrence.

From all that has been stated, it must be considered settled, that the Mackerel Fishery, as a branch of business, cannot be said to exist in New Brunswick, although the eastern shores of the Province, and the whole Bay of Chaleur, offer the greatest facilities, and the most abundant supply of fish.

It is highly desirable that something should be done to encourage and promote this fishery, which evidently offers such ample reward to the energy, enterprise, and industry of the people.

THE SALMON.

Of those Rivers of New Brunswick which flow into the Gulf of Saint Lawrence, the two largest, the Miramichi and the Restigouche, furnish the greatest supply of this well known and delicious fish; but all the smaller Rivers also furnish Salmon in greater or

less numbers. There are also various Bays, Beaches, Islands, and points of land along the coast, where Salmon are intercepted by nets, while seeking the Rivers in which they were spawned, and to which Salmon always return.

The Salmon of the Gulf are noted for their fine flavour; they are precisely similar to the *Salmo salar* of Europe.

The quantities of Salmon in the River Resticouche and Miramichi, at the first settlement of the country, were perfectly prodigious; although many are yet taken annually, the supply diminishes from year to year. And this is not surprising when it is considered that many of the Streams formerly frequented by Salmon, are now completely shut against them, by Mill Dams without "Fishways," or those openings which the British Fishery Reports designate as "Migration Passes;" that in the branches of the large Rivers, as also in the smaller Rivers, nets are too often placed completely across the Stream, from bank to bank, which take every fish that attempts to pass—that "close time" in many of the Rivers is scarcely, if at all, regarded—and that, besides the improper use of nets at all seasons, fish of all sizes are destroyed by hundreds, in the very act of spawning, by torch light and spears, at a time when they are quite unfit for human food.

The quantities of pickled Salmon in barrels, exported from the northern Ports of New Brunswick, during the last eight years, are as follows:—

Ports.	1841	1842	1843	1844	1845	1846	1847	1848	Totals.
Dalhousie,	138	273	552	591	565	766	643	381	3909
Bathurst	32	161	250	126	134	216	190	156	1265
Caraquet,	11	20	13	5	..	..	..	3	52
Miramichi,	1614	2295	1093	1616	1836	146	1531	1571	11,702
Richibucto,	20	..	107	137	77	78	61	..	480
Totals,	1815	2749	2015	2475	2612	1206	2425	2111	17,408

Since the establishment of regular Steamers from the Port of St. John to Boston, large quantities of Fresh Salmon,—packed in ice, have been exported, and the commodity has greatly increased in value. If facilities of communication were created by Railway, the fresh Salmon of the Gulf could also be sent abroad in ice, and their value when first caught would be three or four times as great as at present.

The exceeding value of the Salmon Fisheries of Ireland, and

Scotland, cause great attention to be paid by the British Fishery Boards, to the enforcement of most stringent regulations for their preservation and increase. With reference to the preservation of Salmon, the Inspectors of the Irish Fisheries reported to the Board in 1846, as follows :—" In illustration of the benefits of a steady perseverance in a proper system, we may allude to the Foyle, where the produce has been raised from an average of 43 tons previous to 1823, to a steady produce of nearly 200 tons including the Stake Weirs, in the Estuary, and very nearly to 300 tons, as we believe, in the year 1842." The Inspectors also mention the case of the small River of Newport, County Mayo, which was formerly exempt from "close season." In three years, after the Parliamentary Regulations were introduced and enforced, the produce of this River was raised from half a ton, or at the utmost, a ton every season, to eight tons of Salmon, and three tons of white Trout, for the season ending the third year.

The preservation and maintenance of the Salmon Fisheries of New Brunswick generally, is a subject well worthy of earnest attention. To prevent the destruction of the fish during the spawning season, and by improper modes of fishing, as also to provide for the passage of the fish up those Streams which they have formerly frequented, but from which they are now excluded by Mill Dams, some further enactments are absolutely necessary, and more efficient means are required for enforcing the provisions of the law. The most valuable River Fishery of the Province is in a fair way of being rendered valueless, or wholly destroyed ; and as the Rivers are the natural nurseries of the Salmon, the fishery on the coast will, of course, be destroyed also.

Large quantities of Salmon are caught every season on the Labrador coast, in stake-nets placed at the mouths of Rivers, which empty into Bays and Harbours ; these are split and salted in large tubs, and afterwards repacked in tierces of two hundred pounds each. A number of vessels, from Newfoundland and Canada, are engaged annually in this Fishery ; but the American fishing vessels pursue it with great vigour and assiduity, and it is reported that of late years they have found it very profitable.

The quantities of pickled Salmon exported from Newfoundland in 1847, was 4,917 tierces, one half of which was the produce of the Salmon fishery on the coast of Labrador.

THE WHALE.

The extent to which the Whale Fishery is carried on, within the Gulf of Saint Lawrence, by vessels from Newfoundland, is very little known, nor is its value appreciated. The Jersey houses who have fishing establishments in Gaspé, also fit out vessels for this Fishery, which cruise about Anticosti, and the northern shore of the Saint Lawrence. Mr. MacGregor, in an official Report to the Board of Trade, thus describes this Fishery:—"The Whales caught within the Gulf of Saint Lawrence, are those called "humpbacks," which yield on an average about three tons of oil; some have been taken seventy feet long; which produced eight tons. The mode of taking them is somewhat different from that followed by the Greenland Fishers; and the Gaspé fisherman first acquired an acquaintance with it from the people of Nantucket. An active man, accustomed to boats and schooners, may become fully acquainted with everything connected with this Fishery in one season. The vessels adapted for this purpose, are schooners of seventy or eighty tons burthen, manned with a crew of eight men, including the master. Each schooner requires two boats, about twenty feet long, built narrow and sharp, and with pink sterns; and 220 fathoms of line are necessary to each boat, with spare harpoons and lances. The men row towards the Whale, and when they are very near, use paddles, which make less noise than oars. Whales are sometimes taken in fifteen minutes after they are struck with the harpoon. The Gaspé fishermen never go out in quest of them, until some of the smaller ones, which enter the Bay about the beginning of June, appear; these swim too fast to be easily harpooned, and are not besides, worth the trouble. The large Whales are taken off the entrance of the Gaspé Bay, on each side of the Island of Anticosti; and up the River Saint Lawrence as far as Bic."

Mr. Bouchette in his work on lower Canada, represents the Whale Fishery of the Gulf as meriting the attention ot the Legislature, and needing encouragement; by which, he says, the number of vessels employed would be considerably increased, and this important branch of business would be so effectually carried on by the hardy inhabitants of Gaspé, as to compete, in some degree, if not rival, that of the Americans, who were, at the time Mr. Bouchette wrote, almost in exclusive enjoyment of it, and carried on their enterprising fisheries in the very mouths of the Bays and Harbours of Lower Canada.

Sir Richard Bonnycastle, in his work, entitled "Newfoundland

in 1842," says, "the Coast and Gulf Whale Fishery is now being of much value to Newfoundland." Sir Richard states, that the vessels employed are large schooners, with crews of ten men each; that the fishery is pursued during the whole of the summer months along the Coast of Labrador, and in, and through, the Straits of Belleisle; and that Whales of all sizes are taken, from the smallest "finner," up to the largest *Mysticetus*, or great common Oil Whale of the Northern Ocean, which occasionally visits these regions.

It is believed that hitherto, no attempt has been made by the people of New Brunswick, to enter into this Whale Fishery; and it would be a very proper subject for inquiry, whether it might not be profitably conducted by New Brunswick vessels, and the active and enterprising Fishermen of the Bay of Chaleur, who are equally well placed for carrying it on, as their hardy comrades on the Gaspé side of the Bay.

THE SEAL.

As the capture of the Seal is always designated "Seal Fishery," and as it is blended with the other pursuits of the Fisherman, it may be proper to mention it here.

Five kinds of Seals are said to be found in the Northern Ocean; they bring forth their young on the ice early in the Spring, and they float down upon it from the Polar Seas to Labrador, the Coast of Newfoundland, and the Gulf of Saint Lawrence. The two largest kinds are known as the Harp Seal, (*Phoca groenlandica*,) and the Hooded Seal, (*Phoca leonina*). The other three varieties are known as the "Square Flipper," the "Blue Seal," and the "Jar Seal."

Large herds of these Seals are found together upon the fields of floating ice, which, when so occupied, are called "Seal Meadows." The Seal Hunters endeavour to surprise them while sleeping on the ice, and when this occurs they dispatch the young with bludgeons; the old ones which will frequently turn and make resistance, they are obliged to shoot.

Sealing is carried on very extensively from Newfoundland in schooners of about eighty tons burthen, with crews of thirty men. It is attended with fearful dangers; yet the hardy Seal Hunter of Newfoundland, eagerly courts the perilous adventure.

The following Return of the number of Seal Skins exported from Newfoundland from 1831 to 1848 inclusive, will furnish some idea of the value of the Seal Fishery to that Colony:—

1838	375,361	1844	685,530
1839	437,501	1845	352,202
1840	631,385	1846	
1841	417,115	1847	436,831
1842	344,683	1848	521,004
1843	651,370		

The outfit for the "Seal Fishery" from the various Harbours of Newfoundland in the year 1847, was as follows:—

Vessels.	Tons.	Men.
321	29,800	9,751

Sealing among the ice, is also prosecuted, in early spring, at the Magdalen Islands; and also on the Labrador Coast, by the people who remain there during the winter in charge of the Fishing Stations, and the conduct of the Fur Trade. Seals are also caught at Labrador on the plan first adopted, by strong nets set across such narrow channels as they are in the habit of passing through.

Within a few years, the "Seal Fishery" has been commenced at Cape Breton, encouraged by a small Provincial bounty; it has been conducted in vessels not over 40 tons burthen, with crews of eight men. In 1843, twenty-two vessels went to the ice from Cheticamp and Margaree, and returned with near 10,000 Seals, which are stated to have amply requited those engaged in the adventure, as their outfit was on a very limited scale. In 1842, an enterprising Merchant of Sydney fitted out a Sealing vessel, on the Newfoundland scale, which in the short space of three weeks cleared the round sum of £14,000; and this extraordinary success encouraged others to enter into the business.

As yet, Sealing is altogether unknown to the inhabitants of New Brunswick; although it is believed that the adventure might be made successfully, by vessels departing from the north eastern extremity of the Province.

The Harbour Seal (*Phoca vitulina*) is frequently seen along the coasts of New Brunswick during the summer season, and is believed not to be migratory. They are closely watched by the Micmac Indians, who often succeed in shooting them. The fur of these Seals is sometimes very handsome; and the animal is always a rich prize to the poor Micmac.

SHELL FISH.

Under this head may be enumerated Lobsters, Oysters, Clams, Mussels, Whelks, Razor-fish, Crabs, and Shrimps, all of which are found in the Gulf, in the greatest abundance, and of excellent

quality. Mr. MacGregor states, that they are all equally delicious with those taken on English, Irish, Scotch, or Norweigian Shores.

Lobsters are found everywhere on the coast, and in the Bay of Chaleur, in such extraordinary numbers, that they are used by thousands to manure the land. At Shippagan and Caraquette, carts are sometimes driven down to the beaches at low water, and readily filled with Lobsters left in the shallow pools by the recession of the tide. Every potato field near the places mentioned, is strewn with Lobster shells, each potato hill being furnished with two, and perhaps three, Lobsters.

Within a few years, one establishment has been set up on Portage Island, at the mouth of the Miramichi River, and another at the mouth of the Kouchibouguac River, for putting up Lobsters, in tin cases, hermetically sealed for exportation. In 1845, no less than 13,000 cases of Lobsters and Salmon were thus put up at Portage Island. In 1847, nearly 10,000 cases of Lobsters only, each case containing the choicest parts of two or three Lobsters, and one and a half tons of fresh Salmon, in 2℔ and 4℔ cases, were put up at Kouchibouguac. The preservation of Lobsters, in this manner, need only be restricted by the demand, for the supply is almost unlimited.

The price paid for Lobsters at the establishment on Portage Island when the writer visited it, was two shillings and six pence currency (two shillings sterling) per hundred. They were all taken in small hoop-nets, chiefly by the Acadian French of the Neguac Villages, who, at the price stated, could with reasonable diligence, earn one pound each in the twenty four hours; but as they are somewhat idle, and easily contented, they would rarely exert themselves to earn more than ten shillings per day, which they could generally obtain by eight or ten hours attention to their hoop-nets.

Oysters are found all along the New Brunswick Coast,-from Baie Verte to Caraquette, but not within the Bay of Chaleur. Those best known in this Province for their fine quality, are the Oysters of Shediac; but the extensive beds which formerly existed there, have been almost wholly destroyed by improper modes of fishing, an utter disregard of the spawning season, and the wanton destruction of the fish by throwing down shells upon the beds. It is a singular fact, that ice will not form over an Oyster bed, unless the cold is very intense indeed; and when the Bays are frozen over in the winter, the Oyster beds are easily discovered by the water above them remaining unfrozen, or as the French residents say,

degèlé. The Oysters are then lifted upon the strong ice with rakes; the process of freezing expands the fish, and forces open the shells; the Oyster is removed, and the shells are allowed to fall back into the water, where they tend to destroy the fishery.

Some Oysters of very large size and good quality are found at Tabusintac, but those of the finest description are found on extensive beds in Shippagan Harbour, Saint Simon's Inlet, and Caraquette Bay, from which localities they are exported every season to Quebec. The number of bushels exported from the port of Caraquette during the last eight years, is as follows:—

1841,........5,000	1845,........2,010
1842,........7,000	1846, ...1,915
1843,........5,290	1847,........ 425
1844,........6,000	1848,........5,432

Oysters are abundant at Cocagne, Buctouche, Richibucto Burnt Church, and other places on the coast; but in general, they are too far within the mouths of the fresh water streams, and their quality is greatly inferior to those affected by sea water only.

From the manner in which the Oyster Fishery of the Gulf Shore is now being conducted, all the Oysters of good quality will, in a few years, be quite destroyed. The preservation of this fishery is of considerable importance, and it might be affected as well by judicious regulations and restrictions, as by encouraging the formation of artificial beds, or "Layings," in favourable situations. Several persons on the coast intimated to the writer, their desire to form new and extensive beds in the sea water, by removing oysters from the mixed water of the estuaries, where they are now almost worthless, if they could obtain an exclusive right to such beds when formed, and the necessary enacments to prevent their being plundered.

There are two varieties of the Clam, distinguished as the "hard-shell," and the "soft-shell." They are eaten largely in Spring, when they are in the best condition; and great quantities are used as bait for Cod. Clams are much prized by persons residing at a distance from the sea coast, and they are frequently sent into the interior, where they meet a ready sale, as they can be sold at a very low price.

The Razor fish derives its name from the shells being shaped very like the handle of a razor; the fish is well flavoured in the proper season, and not unlike the Clam, though somewhat tougher.

Crabs of all sizes, are to be had in abundance, but they are not often caught; neither are the Shrimps, which are to be seen in endless quantities. At times, the waters of the Straits of Northumberland appear as if thickened with masses of Shrimps moving about, their course being plainly indicated by the fish of all descriptions, which follow in their wake, and feed upon them greedily.

RIVER FISHERIES.

The principal Fsheries in those Rivers of New Brunswick which flow into the Gulf, in addition to the Salmon Fishery already mentioned are those for Gaspereaux, Shad, Basse and Trout. There are also Smelts, Eels, Flounders, and a great variety of small fish.

The Gaspereaux has been noticed under the head of Herring. The fish is found in almost every River, and the Gasperaux fishery has been considered of so much importance, that various Acts of Assembly have, from time to time, been passed for its regulation and protection. But these laws have either been neglected, or not properly enforced, and this fishery is rapidly declining. Very slight obstructions suffice to prevent the Gaspereaux from ascending streams to their old haunts; the dams for mills, or for driving timber, have shut them out in numerous instances from their best spawning grounds, and the greatest injury has in this way been inflicted on the fishery.

The Shad (*Alosa vulgaris* of Cuvier) of the Gulf, are not taken in such numbers, nor are they of so fine quality, as those caught in the Bay of Fundy; comparatively, they are dry and flavourless, owing as is said, to the sandy character of the shores of the Gulf, which are supposed to furnish less of the peculiar food of the Shad, than the muddy Rivers of the Bay of Fundy, where they are taken in such high perfection. This fishery has also been mentioned in several Acts of Assembly; but the habits, and most usual resorts, of the Shad of the Gulf of Saint Lawrence, have not been carefully observed. It is not improbable, therefore, that a better knowledge of the habits of the fish might lead to the fishery becoming more valuable.

The Basse, or Marine Perch, (*Perca labrax* of Cuvier) swim in shoals along the coast, and frequently ascend the Rivers to a considerable distance from the sea, to deposit their spawn. They are taken of all sizes up to 20℔ weight, or even more; but those of 3℔ to 5℔ are considered the best flavoured. They are some-

times salted, but generally they are eaten while fresh. This fishery has also been attempted to be regulated and preserved by law, but evidently with very little success, as it is fast decreasing. Sad havoc is made among the Basse, in the winter season, when they lie in numerous shoals half torpid, in shallow water. A large hole is cut in the ice above them, and they are lifted out with dip-nets; in this manner the Basse Fisheries, in some of the smaller Rivers, have been wholly destroyed

There are two species of Trout found in the greatest abundance in every river, stream, and brook, which finds its way from the interior of New Brunswick to the Gulf of Saint Lawrence. Of these, the Salmon Trout (*Salmo trutta*) is of the largest size, and most valuable. The common Trout (*Salmo fontinalis*) is taken in every possible variety, every where.

The Sea Trout, (*Salmo trutta marina*) seldom ascend the Rivers far above the tideway; when they first enter the estuaries early in the season, they are in the finest condition, and scarcely, if at all, inferior to Salmon. They are frequently taken of the weight of 7 ℔, though the most usual weight is from 2 ℔ to 5 ℔. They are very abundant in June, in the Bays and Harbours o Prince Edward Island. At the Magdalen Islands they are taken in nets, and being pickled in small casks, are exported to the West Indies; if carefully cleaned, cured, and packed, they there bring a higher price than Salmon.

In the tide-way of the Rivers flowing into the Gulf, these fine fish might be taken in sufficient quantities to form an article of traffic. They afford great sport to the fly-fisher, especially when they first enter the mixed water of the tide-way in the smaller Rivers.

The common Trout (*Salmo fontinalis*) are also eagerly sought after by the disciples of Izaak Walton; and although destroyed in the most wanton and reckless manner by unthinking persons, they are still abundant. The destruction of these beautiful fish takes place by wholesale, upon many Rivers in the northern part of the Province, and one of the modes practised is called "rolling for trout." When the streams are at their lowest stage in the summer season, a dam of logs, stones, and brush, is roughly built at the lower end of some pool, in which the fish have congregated. This "rolling-dam" being constructed, the stream for some distance above the pool, is beaten with poles, and the fish are driven down to the deepest water, out of which they are swept with a net.

The writer was informed, that in this way 3,600 Trout had been taken out of one pool, at a single sweep of the net. In August 1848, 13,000 large Trout were thus taken out of one pool on the Scadouc River, while the writer was at Shediac. This practice is greatly to be deprecated, as by destroying fish of all sizes it completely breaks up the Trout fishery on those Rivers where it takes place.

The Smelt (*Osmerus eperlanus* of Cuvier, and *Osmerus viridescens* of Agassiz,) is found in excessive abundance in all the Rivers and Streams flowing into the Gulf. In the latter part of winter, when in the best condition, they are taken through holes in the ice, and at that season are a very great delicacy; they are then frequently called "frost-fish." Immediately after the ice disappears, they rush in almost solid columns up the brooks and rivulets to spawn, and are then taken by cart-loads. This Fishery, under proper management, might be made one of considerable profit, as the Smelt is really delicious, and always highly esteemed. It is believed that there are two distinct species of this fish, and that the smaller of the two, is more highly scented, as well as more highly flavoured, than the other.

Eels of large size and of fine quality, are taken every where within the Gulf: besides those consumed fresh, they are pickled in considerable quantities, as well for home consumption, as for exportation. Mr. Yarrell, in describing the Eel, says:—"They are in reality a valuable description of Fish; they are very numerous, very prolific, and are found in almost every part of the world. They are in great esteem for the table, and the consumption in our large Cities is very considerable."

In the calm and dark nights during August and September, the largest Eels are taken in great numbers, by the Micmacs and Acadian French, in the estuaries and lagoons, by torch light, with the Indian Spear. This mode of taking Eel requires great quickness and dexterity, and a sharp eye. It is pursued with much spirit, as besides the value of the Eel, the mode of fishing is very exciting. In winter Eels bury themselves in the muddy parts of Rivers, and their haunts, which are generally well known, are called "Eel Grounds." The mud is thoroughly probed with a five pronged iron spear, affixed to a long handle, and used through a hole in the ice. When the Eels are all taken out of that part within reach of the spear, a fresh hole is cut, and the fishing goes on again upon new ground.

If a market should be found for this description of Fish, they could be furnished to an unlimited extent.

The common Flounder (*Platessa plana* of Mitchel,) is found in such abundance in the Gulf, that it is used largely for manuring land. The writer has seen Potatoes being planted in hills, when the only dressing consisted of Fresh Flounders, which were used with a lavish hand. They are seldom taken by the inhabitants of the Gulf Shore, who can readily obtain so many other descriptions of Fish of superior quality. The Flounder is long lived out of the water, and bears land carriage better than most Fish; there is no reason therefore, why Flounders should not become a valuable commodity.

That the varied, extensive, and most abundant Fisheries of the Gulf of Saint Lawrence, would be greatly influenced by the construction of a Railway along the Eastern Coast of New Brunswick, there cannot be a reasonable doubt; but in all probability the proposed Railway from Shediac to the Harbour of Saint John, would affect those Fisheries in an equal, if not a greater degree.

The hardy and enterprising Fisherman on the Bay of Fundy, dread the long and dangerous voyage around the whole Peninsula of Nova Scotia, to the fishing grounds of the Gulf, a voyage which frequently lasts three weeks, and is deemed by Underwriters equally hazardous with a voyage to Europe; but it is not alone the dangers of the voyage which deters them from the prosecution of these Fisheries; it is the great loss of time they occasion, and the expense they create, as these render the adventure, too often, far from profitable.

A Railway from Shediac to the Port of Saint John, which is open at all seasons of the year, would enable the various products of the Fisheries to reach a Port of shipment in four hours, and the necessity for the long voyage around Nova Scotia would be wholly obviated. The fishing vessels could winter at any of the Ports on the Gulf Shore which they found most convenient; their stores and outfit could be sent up by Railway; and they would, in such case, enjoy the advantage of being on the fishing grounds at the earliest moment in the spring, and the Fisherman could protract his labours until the winter had again fairly set in.

The fresh Salmon, packed in ice, which were sent last season, from Saint John to Boston by the steamers, owing to the facilities of transport in the United States, in three days after they left Saint John, appeared at table, in prime condition, at Albany, Buf-

falo, Niagara Falls, New York, and Philadelphia. If the Salmon of the northern Rivers could be transported by railway to Saint John, they would find a ready market in the numerous towns and villages of the United States, and the Salmon Fishery alone, would prove a perfect mine of wealth to the northern part of the Province.

The immense products which might be obtained by a vigorous prosecution of the Fisheries for Herring, Cod, and Mackerel, would not only furnish a fruitful source of profit to a railway, but they would afford such an amount of remunerative employment to all the productive classes, as almost to defy calculation. They would enable the Province to open up and prosecute, a successful trade with several Foreign countries, with which at present the merchants of New Brunswick have no connection whatever. The farmer also, would be greatly benefitted by the extension of the Fisheries in connection with the railway, because he would not only find a more ready market for his surplus produce, but he would be furnished with wholesome and nutritious food, at all seasons of the year, on the most reasonable terms.

Aided by railways, the Fisheries of the Gulf of Saint Lawrence now of so little importance, and such limited value, would take rank as one of the highest privileges of New Brunswick—its unfailing source of wealth forever hereafter. And while the efforts of the people were successfully directed towards securing these bounties of Providence, lavished with such unsparing hand, they would rejoice in the goodness of an all-wise Creator, and offer up humble but earnest thanks to Almighty God for his exceeding goodness and mercy towards his erring and sinful creatures.

ARTICLE VII.—*Catalogue of Canadian Plants' in the Holmes' Herbarium, in the Cabinet of the University of McGill College.* Prepared by the late Prof. JAMES BARNSTON, M.D.

[INTRODUCTORY NOTE.—The plants comprising this herbarium were collected and determined by Prof. A. F. Holmes, M. D., in the year 1820 and following years, and were presented by him to the University in 1856. They are admirably prepared and in

an excellent state of preservation, and represent in a very complete manner the Flora of the Island of Montreal and its vicinity. Under the care of the late Prof. Barnston, they were arranged according to the classification of Gray; the nomenclature was modernized, and a catalogue partly prepared, to which it was his intention to have added the results of his own researches, and to have published the whole as a synopsis of the Flora of Montreal. In its present form, the catalogue fails far short of this design; but it is hoped that its publication may nevertheless be regarded as a useful contribution to Canadian Botany. The Island of Montreal is geographically a very important station. Situated between the parallels of 45° and 46° N. lat., at the confluence of the St. Lawrence and the Ottawa, and presenting a great variety of soil and elevation, it affords an epitome of the botanical conditions of the middle region of Canada. The present collection also derives additional interest from the circumstance, that it affords many localities of species which have become locally extinct, owing to the progress of cultivation and the extension of the city. Lastly, the herbarium of the College being arranged in such a manner as to be easily accessible, it is hoped that the present catalogue may make it more useful to students of botany, and that it may form a groundwork for a complete Flora of the vicinity of Montreal.

The names in the catalogue are those attached to the specimens by Dr. Holmes. The more modern names, where any change has occurred, are added with the initials J. B. The Grasses and Carices of the collection, and a separate collection of Forest Trees and Shrubs, still remain unarranged, and will, if possible, be published in a supplementary list.—J. W. D.]

Ranunculaceæ.

Atragene Americana. June 4, 1822. Mountain.
Clematis Virginica. August 20, 1821. Below Hallowell's House.
Anemone Pennsylvanica. June 16, 1821. Papineau Woods, &c.
" Virginiana. July 8, 1821. Mountain.
Thalictrum dioicum. Meadow Rue.
" cornuti.
Hepatica triloba. May 4, 1821. Mountain.
Ranunculus filiformis. August 13, 1821. St. Helen's Island. (R. flammula, var. reptans, Gray, J. B.)
Ranunculus fluviatilis. June 27, '21. River St. Pierre. (R. Purshii, Torr. and Gray, J. B.)
Ranunculus delphinifolius. June 29, 1821. Lachine Woods. (R. Purshii, Torr. and Gray, J. B.)
Ranunculus hirsutus. July 23, 1821. Meadows near Gregory's. (R. Pennsylvanicus, Linn., Gray, J. B.)

Ranunculus acris (crowfoot, buttercup). June 18, 1821. Common.
" repens. August 10, 1821. Common.
" abortivus. June 21. Mountain.
" lanuginosus. June 11, 1821. Mountain. (R. recurvatus, J. B.)
Coptis trifolia (gold-thread). May 20, 1821. Mountain.
Caltha palustris (marsh marigold). May 23, 1821. Meadows, &c.
Aquilegia Canadensis (columbine). May 20, 1821. Mountain.
Actæa alba (bane-berry). May 31, 1821. Mountain.
" rubra. May 15, 1821. Papineau Road.

Menispermaceæ.
Menispernum Canadense (moonseed). July 19, 1821. St. Martin.

Berberidaceæ.
Podophyllum peltatum (may-apple). 1821. In a garden, at Nicholson's, on the mountain.

Cabombaceæ.
Hydropeltis purpurea (water shield). Sept. 3, 1821. River, near Point St. Charles. (Brasenia peltata, Pursh, J. B.)

Nymphæaceæ.
Nymphæa odorata (pond-lily). July 23, 1821. Mouth of St. Pierre.
Nuphar advena (yellow pond-lily). July 23, 1821. River St. Pierre, &c.

Sarraceniaceæ.
Sarracenia purpurea (pitcher-plant, Indian cup). June, 1820. Savanne, St. Michel.

Papaveraceæ.
Chelidonium majus (celandine). Roadside. 1821.
Sanguinaria Canadensis (blood-root). May 15, 1821. Mountain, Papineau Woods.

Fumariaceæ.
Corydalis glauca. June 16, 1821. Papineau Road.
" Canadensis (squirrel corn). May 7, 1822. Mountain. (Dicentra Canadensis, DC. Gray. J. B.)
Corydalis cucullaria (Dutchman's breeches). May 7, 1822. Mountain. (Dicentra cucullaria, DC. Gray. J.B.)

Cruciferæ.
Nasturtium amphibium. Br. and DC. July 23, 1821. Gregory's Creek.
Sisymbrium (Nasturtium) palustre. July 21, 1821. In a yard.
Dentaria diphylla (pepper-root). May 31, 1821. Mountain.
Cardamine Pennsylvanica (bitter cress). June 7, 1822. Nuns' Island, Lachine Wood. (C. hirsuta. J. B.)
Turritis (Arabis) lævigata. June 22, 1821. Mountain.
Erysimum Barbarea (winter cress). June 6, 1821. Nichol's Gully. (Barbarea vulgaris, Torr.)
Sinapis alba (white mustard). 1821. Common.
" nigra (black mustard). 1821. Common.
Thlaspé bursa-pastoris (shepherd's purse). July 11, 1821. Common. (Caprella, Vent.)
Thlaspé arvense. July 21. Common.
" campestre (Lepidium campestre). July 3, 1822. In a field, Three Rivers.
Lepidium Virginicum (wild pepper grass). Aug. 2, 1821. Roadside, Citadel Hill.

Capparidaceæ.
Cleome dodecandra. Aug. 13, 1821. Shore St. Helen's. (Polanisia graveolens, Raf., Gray, J. B.)

Violaceæ.
Viola Canadensis (Canada violet). May 31, 1821. Mountain, &c.

Viola pubescens (downy yellow violet). May 23, 1821. Papineau Woods.
" blanda (sweet white violet). May 25, 1822. Savanne, &c.
" Selkirkii (great-spurred violet). Goldie.
" striata (pale violet). May 13, 1821. Swamp, St. Denis-st.
" cucullata (common blue violet). Mountain.
" sagittata (arrow-leaved violet). May 30, 1825. Nuns' Island, Berthier, &c.

Parnassiaceæ.

Parnassia Caroliniana. 1820.

Hypericaceæ.

Hypericum ascyroides (great St John's-wort). July 29, 1821. Swamp, St Denis Street. (H. pyramidatum, Torr., J. B.)
" Canadense. July 29, 1821. Meadows between Suburbs.
" perforatum (common St. John's-wort). July 28, 1821. Swamp, St. Denis Street.
" corymbosum. July 27, 1821. Swamp, St. Denis Street, et aliis, August 8, Gregory's Woods.

Hypericum Virginicum. Aug. 11, 1821. Woods beyond Gregory's.
" sphærocarpon. July 9, 1821. Shore near River St. Pierre. (H. hypericum, J. B.)
" parviflorum. 1821. Papineau Woods. (H. mutilum, J. B.)

Caryophyllaceæ.

Alsine media (chickweed). 1821. Common. (Stellaria media, Smith [see Torrey], J. B.)
Stellaria graminea (stitch-wort). June 29, 1821. Lachine Woods. (S. longifolia, J. B.)
Arenaria lateriflora. June 16, 1821. Papineau Road. (Mœhringia laterifolia, Gray, J. B.)
Cerastium dichotomum. June 25, 1821. Mountain. (C. oblongifolium, Torrey, J. B.)
" vulgatum (mouse-eared chickweed). June 16, 1821. Common.
" viscosum. June 4, 1822. Mountain side.
Mollugo verticillata (carpet weed). Sept. 27. (An immigrant from further south, Gray.)

Portulacaceæ.

Portulacca oleracea (purslane). August 14, 1821. Common.
Claytonia Virginica (spring beauty). May 7, 1822. Mountain. (Is not this C. Caroliniana, Michaux. J. B.)

Malvaceæ.

Malva rotundifolia (Mallow). August 1, 1821. Common.

Oxalidaceæ.

Oxalis Dillenii (wood-sorrel, sheep-sorrel). June 29, 1821. Very common. (O. stricta, J. B.)
" acetosella (wood-sorrel). July 10, 1822. Woods near Montreal, Portages of Black River, Three Rivers.

Geraniaceæ.

Geranium Carolinianum (Cranesbill),
" Robertianum (herb Robert) Isle aux Hurons.

Balsaminaceæ.

Impatiens noli-me-tangere (balsamine). Aug. 9, 1821. Common in most brooks, (I. fulva, I. biflora, Pursh, J. B.)
" biflora. Aug. 31, 1821. Mountain. (I. pallida, I. noli-me-tangere, Pursh and Michaux, J. B.)

Limnanthaceæ.

Flœrkea lacustris. June 7, 1822. Nuns' Island. (F. proserpinacoides, Willd., Gray, J. B.)

Rutaceæ.

Zanthoxylum fraxineum (pricky ash). June 3, 1821. Garden. (Z. Americanum.)

Anacardiaceæ.

Rhus typhina (stag's-horn sumach). July 18, 1821. Mountain.
" toxicodendron (poison ivy), var. quercifolium. June 20, 1821. Below McGillivray's.

Vitaceæ.

Vitis riparia (wild grape, winter grape). June 13, 1821. In an orchard. (V. cordifolia, var. riparia, J. B.)
Cissus hederacea (American ivy), Pursh. Sept. 18, 1821. Mountain. (Ampelopsis quinquefolia, Michaux, J. B.)

Rhamnaceæ.

Rhamnus alnifolius (buck-thorn). June 4, 1821. Savanne, St. Michel.

Celastraceæ.

Celastrus scandens (wax-work). June 13, 1821. Nichol's garden.

Sapindaceæ.

Staphylea trifolia (bladder-nut). July 19, 1821. St. Martins.
Acer saccharinum (sugar maple). June 5, '21. Above Cleghorn's.
" rubrum (red maple). April 30, 1824, and Sept. 27.
" spicatum (mountain maple). May 31, 1821. Mountain.

Polygalaceæ.

Polygala verticillata (milk-wort). Sept. 11, 1821. Boucherville Island.
" paucifolia, Blair.

Leguminosæ.

Trifolium repens (white clover). July 8, 1821. Mountain.
" pratense (red clover). June 13, 1821. Papineau Wood.
Astragalus Canadensis. Sept. 8, 1821. Island opposite Point St. Charles.
Hedysarum glutinosum. 1821. Papineau Wood. (Desmodium nudiflorum, DC.)
" acuminatum. Aug. 2, 1821. Mountain, &c. (Desmodium acuminatum, DC.)
" Canadense. July 18, 1821. Cross-road beyond the Tanneries. (Desmodium Canadense, DC.)
Vicia cracca (wild vetch). 1820.
Lathyrus stipulaceus (marsh vetchling). July 9, 1821. Shore, Chapman's Brewery. (L. palustris, var. myrtifolius.)
" venosus. July 23, 1821. River St. Pierre.
" palustris (marsh vetchling). July 14, 1821. St. Martin; also Three Rivers.
(Phaseolus diversifolius, J. B.)
Vicia sativa (common vetch). July 21. Nichol's Gully.
Glycine apios (ground-nut). Aug. 22, 1821. Nichol's Gully, &c. (Apios tuberosa, Torrey.)
" monoica. Aug. 20, 1821. Hallowell's, &c. (Amphicarpæa monoica, Torrey.)

Rosaceæ.

Prunus Pennsylvanica (wild cherry). May 22, 1821. Nichol's. (Cerasus Pennsylvanica, J. B.)
" serotina (choke cherry). May 29,'21. Nichol's. (?Virginiana.)
Spiræa latifolia (meadow sweet). Aug. 2, 1821. Papineau Woods. (S. salicifolia, Gray, J. B.)
" tomentosa, second specimen. August 2, 1821, Papineau Woods, &c.
" opulifolia, second specimen. July 19, 1821. St. Martin.
Agrimonia eupatoria. July 19, 1821. Below Quesnel's.
Sanguisorba Canadensis (Canadian burnet). 1820. Savanne.

Geum rivale (purple avens). June 11, 1821. Hallowell's, &c.
" album. June 29, 1821. Lachine Woods. (G. Virginianum, Gray, J. B.)
" strictum (Canadense). July 8, 1821. Mountain.
Potentilla anserina. June 18, 1821. Common.
" palustris.
" fruticosa. June 4, 1821. Savanne. July 14, 1821.
" tridentata. July 2, 1822. Three Rivers.
" Norvegica. July 19, 1821. Common.
" simplex (cinquefoil). June 22, 1821. Field above Cemetière. (P. Canadensis.)
Fragaria Canadensis (Virginian strawberry). May 18, 1821. Common.
Dalibarda repens. July 14, 1821. Savanne et aliis.
Rubus villosus (blackberry). June 11, 1821. Mountain.
" strigosus (wild raspberry). June 29, 1821. Lachine Wood.
" odoratus (purple-flowering raspberry). June 22, 1821. Mountain.
" trivialis (low blackberry). June 22, 1821. Mountain. (R. Canadensis, Gray, J. B.)
" trifloris (dwarf raspberry) May 15,'21. Papineau Woods,&c.
" occidentalis (black raspberry). June 6, 1821. McGillivray's.
Rosa Carolina. June 20, 1821. Below McGillivray's. (Probably R. blanda, J. B.)
" Carolina. July 23, 1821. Bank of River St. Pierre.
" rubiginosa (sweet-briar). June 20, '21. Below McGillivray's.
Cratægus coccinea (scarlet-fruited thorn). May 30, 1821. Nichol's.
" crus-galli (cock-spur thorn). June 6, '21. McGillivray's.
" tomentosa (black or pear thorn), var. punctata, Gray.
Aronia melanocarpa. June 16, 1821. Papineau Woods. (Pyrus arbutifolia, Torrey, J. B.)
" ovalis (shad-bush). May 31, 1821. Mountain. (Amelanchier Canadensis, var. oblongifolia, Torrey.)
" botryapium. May 20, 1821. Mountain. (Amelanchier Canadensis.)
Sorbus Americana (mountain ash). June 16, 1821. Papineau Woods. (Pyrus Americana, DC.)

Lythraceæ.

Lythrum verticillatum. Aug. 8, 1821. Mouth of River St. Pierre. (Nescea verticillata, J. B.)

Onagraceæ.

Œnothera muricata. July 19, 1821. Below Quesnel's. (Œ. biennis, var. muricata.)
" biennis (evening primrose). July 19, 1821. Below Quesnel's, et aliis. (Var. grandiflora, J. B.)
" pusilla. June 18, 1821. (Œ. pumila, J. B.)
Epilobium augustifolium (willow herb). July 14, 1821. Savanne, et aliis.
" tetragonum. July 29, 1821. Swamp, St. Denis Street. (E. coloratum, Torrey, J. B.)
" palustre. August 11, 1821. Woods beyond Gregory's. (Probably E. coloratum, J. B.)
" lineare. August 11, 1821. Gregory's Meadows. (E. palustre, var. lineare, Gray, J. B.)
Isnardia palustris (water purslane). July 23, 1821. Bank of the River St. Pierre. (Ludwigia palustris, Ell., Gray, J. B.)
Circæa Lutetiana (enchanter's night-shade). July 14, 1821. Savanne, &c.
" Alpina. July 12, 1821. Mountain, &c.

Myriophyllum spicatum (water milfoil). July 23, 1821. Gregory's Pond.

Grossulaceæ.

Ribes ——? June 4, 1854. Savanne. (Char. very close to R. rotundifolium, Michaux, Torrey, J. B.)
" triflorum (wild gooseberry). May 30, 1821. Papineau Woods. (Very likely R. cynosbati [see Torr. and also Gray] J. B)
" floridum (wild black currant). May 22, 1821. Hallowell's Swamp, &c.
" rubrum (red currant). May 30, 1821.
" prostratum (fetid currant). L'Iber.
" lacustre (swamp gooseberry). June 4, 1821. Savanne.

Cucurbitaceæ.

Sicyos angulatus (star cucumber). Sept. 18, 1821. Field between Suburbs.

Crassulaceæ.

Penthorum sedoides (Ditch stone-crop). July 23, 1821. Edge of River St. Pierre.

Saxifragaceæ.

Saxifraga nivalis (early saxifrage). May 20, 1821. Mountain. (S. Virginiensis, J. B.)
Chrysoplenium Americanum (golden saxifrage). 1821. Mountain.
Mitella dyphilla (mitre wort). May 23, 1821. Mountain.
" cordifolia. June 4, 1821. Savanne, &c. (M. nuda, J. B.)
Tiarella cordifolia. May 23, 1821. Mountain.

Umbelliferæ.

Pastinaca sativa (parsnip). July 19, 1821. Common.
Heracleum lanatum (cow parsnip). June 30, 1821. Bank, mouth of the River St. Pierre.
Smyrnium integerrimum. June 22, 1821. Small mountain. (Zizia integerrina, DC., J. B.)
" aureum. June 7, 1822. Nuns' Island. (Thaspium aureum, Nutt, Gray, J. B.)
Sanicula Marilandica (snake root). June 18, 1821. Mountain, &c.
Cicuta maculata (spotted cowbane). July 19, 1821. Fields below McGillivray's, &c.
" bulbifera. Aug. 11, 1821. Woods beyond Gregory's.
Sium lineare. July 23, 1821. Bank of River St. Pierre.
" latifolium. July 27, 1821. Near Gregory's.
Chærophyllum Canadense. (Cryptotænia Canadensis, DC. Torrey, J. B.)
Myrrhis longistylis (smooth sweet cicely). June 29, 1821. Lachine Woods. (Osmorrhiza longistylis, DC., J. B.)
Chærophyllum Claytoni (hairy sweet cicely). June 11, 1822. Lachine Woods, Mountain. (Osmorrhiza brevistylis, DC., see Torrey, J. B.)

Araliaceæ.

Aralia racemosa (spikenard). August 2.
" nudicaulis (wild sarsaparilla). June 11, 1821. Mountain.
" hispida (bristly sarsaparilla). July 5, 1822. Three Rivers.
" trifolia (dwarf ginseng). May 15, 1821. Papineau Woods.
Panax quinquefolia (ginseng). 1821. Mountain. (Aralia quinquefolia, J. B.)

Cornaceæ.

Cornus Canadensis (bunch-berry, pigeon-berry). 1821. Not uncommon.
" alternatifolia. Aug. 31, 1825.
" sericea (silky cornel or dogwood). June 30, 1825.
" circinata (round-leaved dogwood). 1821.
" alba (red-osier dogwood). 1821. (C. stolonifera, Michaux, J. B.)

Caprifoliaceæ.

Lonicera parviflora (small honeysuckle). 1821. Mountain.

Xylosteon ciliatum (fly honeysuckle). May 25, 1822. Savanne and Papineau Woods. (Lonicera ciliata, Muhl., Gray, J. B.)

Lonicera oblongifolia (swamp honeysuckle), Muhl., J. B.

Linnæa borealis (twin flower). July 14, 1821. Savanne, &c.

Diervilla humilis (bush honeysuckle). 1821. Mountain. (Diervilla trifida, Mœnch, Gray, J. B.)

Triosteum perfoliatum. Oct. 3, 1821. Papineau Woods.

Sambucus Canadensis (elder), July 18, 1821. Roadside, cross-road near Côte St. Hilaire.

" pubescens (red-berried elder). May 20, 1821. Mountain. (S. pubens, Gray, J. B.)

" ebulus. July 7, 1821. Roadside, Côte St. Antoine. (Dwarf-elder mentioned in Hooker, Gray and Torrey, J. B.)

Viburnum oxycoccus (tree-cranberry). June 8, 1821. Nichol's Gully. (V. opulus, L., Gray and Torrey, J. B.)

" lentago (sheep-berry). June 6, 1821. Nichol's Gully.

" acerifolium. July 16.

" lantanoides. 1820.

" nudum. July 2, 1822. Three Rivers; also wood above Cadieux. (Approaches var. cassinoides, Gray, J.B.)

Rubiaceæ.

Galium asprellum (rough bedstraw). 1821. Common.

" Bermudianum. June 22, 1821. Mountain. (More likely G. Circæsans [see Gray, Torrey and Hooker], J. B.)

" triflorum. June 22, 1821. Mountain.

" strictum. July 29. (Equivalent to G. boreale, L, [see Hooker, Torrey and Gray,] J. B.)

" aparine. June 7, 1822. Nuns' Island.

" trifidum. (L. J. B.)

" boreale.

Mitchella repens (partridge-berry). July 14, 1821. Savanne et aliis

Cephalanthus occidentalis (button-bush). August 11, 1821. Gregory's Meadows.

Houstonia (Oldenlandia) purpurea, vel ciliolata. Blair, Belleville, and above Fort George.

Houstonia cærulea, Gray.

Compositæ.

Eupatorium verticillatum. 1820. Côte St. Paul. (Eupatorium purpureum, J. B.)

" maculatum. August 24, 1821. Papineau Woods. (Eupatorium purpureum.)

" ageratoides (white snake-root). August 20, 1821. Hallowell's.

" perfoliatum (thorough-wort). August 9, 1821. Between Recollet Street and St. Antoine Suburbs.

Aster divergens. Aug. 28, 1821. Nichol's. (A. miser, var. J. B.)

" lanceolatus? Aug. 22, 1821.

" macrophyllus. Aug. 31, 1821. Mountain.

" patens. August 31, 1821. Common.

" cordifolius. August 28, 1821. Common.

" rigidus. Sept. 10, 1821. (Diplopappus linarifolius.)

" sagittifolius. Sept. 3, 1821. Côte St. Paul.

" amygdalinus, Pursh. (A. umbellatus, Aiton.) Aug. 11, 1821. Woods beyond Gregory's. (Diplopappus umbellatus, Torrey and Gray.)

Aster puniceus. August 20, 1821. Hallowell's.
" acuminatus. August 17, 1821. Mountain.
Erigeron heterophyllum (scabious). Aug. 28, 1821. Cross-road, Côte des Neiges. (Erigeron annuum.)
" strigosum. July 14, 1821. Savanne.
" Canadense (horse-weed). Aug. 2, 1821. Papineau Road.
" purpureum (flea-bane). June 13, 1821. Mountain. (E. Philadelphicum.)
Solidago livida. Sept. 8, 1821. Côte St. Paul. (S. cæsia.)
" latifolia. August 17, 1821. Mountain.
" bicolor. August 31, 1821. Mountain.
" macrophylla. August 3, 1824.
" nemoralis. Aug. 31, 1821. Field above Cleghorn's.
" altissima, var. vulgaris. Aug. 24, '21. Papineau Woods.
" procera. August 20, 1821. Wood below Hallowell's. (S. Canadensis, var. procera, Torrey, J. B.)
" Canadensis. Aug. 3, 1821. Nichol's Gully, &c. &c.
" lanceolata. Sept. 8, 1821. Côte St. Paul.
Ambrosia artemisifolia (Roman rag-weed). Roadside.
" trifida (great rag-weed). August 8, 1821. Common.
Xanthium strumarium (cockle-bur). August 13, 1821. Bridge, River St. Pierre.
Rudbeckia laciniata (cone-flower). August 28, 1821. Cross-road, Côte des Neiges; also River St. Pierre.
Helianthus decapetalus (wild sunflower). Aug. 17, 1821. Mountain.
" tracheleifolius. August, 1821. Mountain.
Bidens pilosa (tick-weed). July 17, 1821. Field above French burying-ground.
" connata (swamp beggar-ticks), August 17, 1821. Field above French burying-ground.
" Beckii (water-marigold). August 27, 1821. River, near Point St. Charles.
" cernua (bur-marigold). Sept. 3, 1821. Côte St. Paul. Common.
Helenium autumnale (sneeze-weed). Sept. 11, 1821. Boucherville Islands.
Achillea millefolium (yarrow). 1821. Common.
Anthemis cotula (May-weed). 1821. Very common; roadside. (Maruta cotula.)
Chrysanthemum Leucanthemum (white-weed). June 13, 1821. (Leucanthemum vulgare.)
Artemisia vulgaris (mug-wort). Sept. 8, 1821. Common.
Gnaphalium uliginosum (cud-weed). August 20, 1821. Between suburbs.
" luteo-album? Sept. 8, 1821. Côte St Paul.
" margaritaceum (pearly everlasting). August 2, 1821. Papineau Wood. (Antennaria margaritacea, J. B.)
" plantaginifolium (plantain-leaved everlasting). 1821. Common. (Antennaria plantaginifolia, J. B.)
Senecio vulgaris (groundsel). July 7, 1822. Roadside.
" hieracifolius (fire-weed). August 15, 1821. Roadside. (Erechtites hieracifolia.)
Cnicus altissimus (tall thistle). Aug. 28, 1821. Road St. Catherine. (Cirsium altissimum, J. B.)
" muticus (swamp thistle). (Cirsium muticum.)
" discolor. August 17, 1821. Field above French burying-ground. (Cirsium discolor.)
" horridulus (yellow thistle). 1821. Very common. (Cirsium horridulum.)

Arctium lappa (burdock). August 7, 1821. Common. (Lappa major, Gray, J. B.)

Cichorium intylus (chicory). July 19, 1821. Rather common.

Leontodon taraxacum. 1821. Very common. (Taraxacum dens-leonis.)

Hieraceum Kalmii (Canada hawk-weed). Aug. 17, 1821. Mountain. (H. Canadense, Torrey, J. B.)

Hieracium paniculatum (panicled hawk-weed). August 2, 1821. Papineau Wood.

" Marianum (rough hawk-weed). Aug. 24, 1821. Gully, Papineau Road. (H. scabrum, Torrey, J. B.)

Prenanthes cordata (tall white-lettuce). Aug. 24, 1821. Papineau Wood. (Nabalus altissimus, Torrey, J. B.)

" virgata? Aug. 17, 1821. Mountain.

" alba (white-lettuce). Sept. 8, 1821. Côte St. Paul. ("Nabalus albus.")

" racemosa. August 11, 1821. Hallowell's. (Nabalus racemosus.)

Sonchus arvensis (corn sow-thistle). August 19, 1821. Between suburbs.

" palustris. Aug. 17, 1821. Between suburbs.

" leucophaeus. July 14, 1821. Savanne, et aliis. (Mulgedium leucophæum, Gray, J B.)

" oleraceus (sow-thistle). July 19, 1821. Below Quesnel's.

Lactuca elongata (wild lettuce). Aug. 24, 1821. Papineau Wood.

Lobeliaceæ.

Lobelia cardinalis (cardinal flower). Sept. 3, 1821. Gulley, Côte St. Paul.

" inflata (Indian tobacco). Aug. 2, '21. Papineau Wood, &c.

" Kalmii. Sept. 11, '21. Côte St. Paul, Boucherville Islands.

Campanulaceæ.

Campanula rotundifolia (harebell). July 20, 1822. Falls of Grande Mou, River St. Maurice.

" aparinoides (marsh bellflower), Pursh. Aug. 17, 1821. Meadow between suburbs.

Ericaceæ.

Vaccinium corymbosum (swamp blueberry), Torrey, J. B.

" Pennsylvanicum (Torrey), (or V. corymbosum, var. pallidum, of Gray, J. B.

" oxycoccus (small cranberry). Oxycoccus palustris. 1820. Savanne St. Michel.

Gaultheria hispidula (creeping snowberry). August 21, 1821. (Chiogenes hispidula, Torrey and Gray, J. B.)

" procumbens (winter-green, tea-berry, checker berry). Aug. 2, 1821. Papineau Woods.

Epigæa repens (trailing arbutus, May flower). 1821. Three Rivers.

Andromeda polifolia. May 26, 1825.

" calyculata, Torrey. (Cassandra calyculata, Gray, J.B.)

Kalmia glauca (pale laurel). July 14, 1821. Savanne.

" angustifolia (sheep laurel). July 14, 1821. Savanne.

Ledum palustre (Labrador tea). June 4, 1821. Savanne.

Rhodora Canadensis. June 4, 1821, Savanne, and June 14, 1821, wood above Cadieux.

Pyrola rotundifolia. July 8, 1821. Mountain.

" uniflora. July 8, 1821. Mountain swamp, et aliis. (Moneses uniflora, J. B.)

" umbellata. Aug. 2, 1821. Mountain and Papineau Woods. (chimaphila umbellata, J. B.)

" secunda. July 8, 1821. Mountain swamp.

" asarifolia. July 10, 1822. Portage des Grès, Black River. (var. P. rotundifolia.)

Pyrola minor. July 8, 1821. Mountain swamp.
" elliptica (with two bracts). July 2, 1825.
Monotropa uniflora (Indian-pipe, death-flower). August 7, 1821. Mountain.
Ilex Canadensis (mountain holly). June 4, 1821. Savanne. (Nemophanthes Canadensis, DC., Gray, J. B.)
Prinos verticillatus (black alder). July 3, 1822, Wood above Cadieux. Oct. 3, 1821, Papineau Woods. (Ilex verticillata, Gray, J. B.)

Plantaginaceæ.

Plantago major (plantain). 1821. Gregory's Wood. Common.

Primulaceæ.

Lysimachia capitata (tufted loose-strife). July 4, 1822. Island above Nuns' Island. (Naumburgia thyrsiflora, Gray, J. B.)
Lysimachia ciliata. Aug. 2, 1821. Papineau Woods, &c.
" racemosa. June 23, 1821. Gregory's Meadows. (L. stricta, Ait., J. B.)
Trientalis Americana (starflower). June 11, 1821. Mountain, &c.

Lentibulaceæ.

Utricularia vulgaris (bladder-wort). July 23,1821. River St. Pierre.

Orobanchaceæ.

Orobanche Virginiana (beech-drops). Oct. 3, '21. Papineau Woods. (Epiphegus Americanum, Torrey, and E. Virginiana, Gray, J.B.)

Scrophulariaceæ.

Scrophularia Marilandica (fig-wort). June 11, 1821. Mountain. (S. nodosa, J. B.)
Verbascum thapsus (mullein) 1821. Common in fields.
Mimulus ringens (monkey flower). July 12, 1821. Pond at the Cross, et aliis.
Lindermia pyxidaria (false pimpernel). Sept. 8, 1821. Rocks, Point St. Charles. (L. attenuata, Torrey, Ilysanthes gratioloides, Gray, J. B.)
Veronica anagallis (water speedwell). June 27, 1821. Lachine Woods.
" scutellata (marsh speedwell). June 29, 1821. Lachine Woods.
" peregrina (purslane speedwell). June 4, 1822. Rather common, Mountain side.
" serpyllifolia (thyme-leaved speedwell). May 29, 1821. (same with white flowers, Berthier.)
Gerardia purpurea. Aug. 17, 1821. Between the Recollet and St Antoine Suburbs.
Pedicularis Canadensis. May 31, 1821. Mountain.
Melampyrum arvense. July 12, 1822. Three Rivers. (M. Americanum.)

Acanthaceæ.

Justicia pedunculosa (water willow). June 30, 1821. Mouth of the St. Pierre. (Dianthera Americana, J. B.)

Verbenaceæ.

Verbena angustifolia. July 3, 1822. Island above Nuns'.
" hastata (blue vervain). July 18, 1821. Below Quesnel's.
" urticifolia. August 1, 1821. Roadside, Côte St. Antoine, et aliis.
Phrymna leptostachia (lop-seed). July 14, 1821. Savanne, et aliis.

Labiatæ.

Teucrium Canadense (wood-sage). Sept. 11, 1821. Boucherville Island.
Lycopus Europæus. July 29, 1821. Meadows.
" Virginicus (bugle-weed). Aug. 2 1821. Papineau Wood.

Mentha tenuis. Sept. 1, 1821. Roadside, Côte St. Charles. (M. viridis.

Mentha borealis (wild-mint). July 27, 1821. Mouth of River St. Pierre, et aliis. (M. Canadensis, Torrey, J. B.)

Pycnanthemum lanceolatum (mountain-mint). October 10, 1821. Nuns' Island.

Hyssopus petoides. August 17, 1821. Mountain. (Lophanthus nepetoides, J. B.)

Nepeta cataria (catnip). Aug. 7, 1821. Mountain, near McTavish's.

Dracocephalum Virginianum (false dragon-head). Sept. 8, 1821. Small island opposite Point St. Charles. (Physostegia Virginiana, Gray, J. B.)

Prunella vulgaris (heal-all). July 19, 1821. Below Quesnel's.

Scutellaria lateriflora (skull-cap). August 11, 1821. Wood beyond Gregory's.

" galericulata. Aug. 2, 1821. Papineau Woods, et aliis.

" parvula. June 22, '21. Mountain, below Priests' farm.

Galeopsis tetrahit (hemp-nettle). August 1, 1821. Common.

Stachys aspera. Sept. 11, 1821. Boucherville Islands. (S. palustris, var. aspera, Gray, J. B.)

Leonurus cardiacea (mother-wort). September 2, 1821. Roadside, Sherbrooke Street.

Borraginaceæ.

Lycopsis arvensis (small bugloss). June 20, 1821. Open lot, St. James Street.

Lithospermum officinale (gromwell). 1821. Common.

Cynoglossum officinale (hound's-tongue). 1821. Common.

Myosotis lappula (stick-seed). 1821. Common. (Echinospermum lappula, J. B.)

Cynoglossum amplificaule (wild comfrey). June 11, 1821. Mountain. (C. Virginicum, Gray, J. B.)

Hydrophyllaceæ.

Hydrophyllum Virginicum (water-leaf). June 16, 1821. Papineau Woods, &c.

Convolvulaceæ.

Convolvulus sepium (hedge bindweed). July 27, 1821. Near the mouth of River St. Pierre. (Calystegia sepium, R. Br. Gray, J. B.)

Convolvulus stans (low bindweed). July 2, 1822. Three Rivers. (Calystegia spithamæa of Pursh [see Gray and Torrey], J. B.)

Cuscuta Americana (dodder). Sept. 11, 1821. Boucherville Island. (C. Gronovii, Willd., Gray, J. B.)

Solanaceæ.

Solanum nigrum (nightshade). Aug. 8, 1821. Garden, Point St. Charles, &c.

Nicandra physaloides. Sept. 7, 1821. Garden, but wild.

Datura stramonium (thorn-apple). Sept. 3, 1821. Grey Nuns' court.

Hyoscyamus niger (black henbane). 1821. Common, roadside.

Gentianaceæ.

Gentiana saponaria (soapwort gentian). Sept. 3, 1821. Meadows, Côte St. Paul, Sept. 11.

Menyanthes trifoliata (buck-bean). May 28,'21. Pool near the Cross.

Apocynaceæ.

Apocynum hypericifolium (Indian hemp). July 27, 1821. Bridge, River St. Pierre. (A. cannabinea, var. hypericifolium, Gray.)

Apocynum androsæmifolium (dogbane). June 21, 1821. Mountain.

Asclepiadaceæ.

Asclepias syriaca (milkweed, silkweed). July 27, 1821. Common. (A. cornuti, Gray, J. B.)

' incarnata. July 22, '21. Meadows, Recollet Suburb, &c.

Oleaceæ.

Fraxinus epiptera (white ash). June 25, 1821. Mountain. (F. Americana.)

" sambucifolia (black ash). June 5, Nichol's, and May 17.

Aristolochiaceæ.

Asarum Canadense (wild ginger). May 15, 1821. Mountain, Papineau Woods, &c.

Chenopodiaceæ..

Chenopodium album (lamb's quarter). 1822. Common.

" hybridum (goose-foot). Aug. 28, 1821. St. Catherine Wood.

Blitum capitatum (strawberry-blite). 1820.

Atriplex patula (orache). Aug. 22, 1821. Roadside. (A. hastata, Gray, J. B.)

Amarantaceæ.

Amaranthus hypochondriacus (prince's feather). Sept. 17, 1821. Roadside, Bleury Street.

" viridis. Aug. 13, 1821. Vacant lot, St. James Street.

" retroflexus (pig-weed). Sept. 3, 1821. Common.

Polygonaceæ.

Polygonum Persicaria. July 19, 1821. Common.

" lapathifolium. July 21, 1821. Between Suburbs. (P. nodosum, Pers., Gray, J. B.)

" coccineum (amphibium, L.), var. terrestre. Sept. 11, 1821. Boucherville Island.

" Pennsylvanicum. July 23, 1821. Mouth of River St. Pierre, et aliis.

" mite. Sept. 3, 1822. Meadows, Côte St. Paul.

" Virginianum. Sept. 11, 1821. Boucherville Island.

" aviculare. August 11, 1821. (Common with var. P. tenue, J. B.)

" sagittatum. Aug. 17, 1821. Between Suburbs.

" hydropiperoides. Aug. 31, 1821. Very common.

" coccineum. July 29, 1821. Swamp, St. Denis Street. (P. amphibium, var. aquaticum, J. B.)

" scandens. August 20, 1821. Near Hallowell's. (P. dumetorum, Gray, J. B.)

" convolvulus. July 19, 1821. Below Quesnel's.

Rumex Britannicus (swamp dock). August 11, 1821. Gregory's meadows. (See Torrey, also Gray, R. verticillatus.)

" verticillatus. June 29, 1821. Lachine Road.

" crispus (curled dock). 1821. Common.

" obtusifolius (bitter dock). July 13, 1821. Ditch near Beaver Hall.

" acetosella (field sorrel). June 16, 1821. Papineau Road, common.

Thymeleaceæ.

Dirca palustris (leather-wood).

Euphorbiaceæ.

Euphorbia Helioscopia (sun-spurge).

Acalypha Caroliniana. Aug. 7, 1821. Common.

Urticaceæ.

Ulmus Americana (elm). April 30, 1824. Nichol's Gully, &c.

" fulva (slippery or red elm). April 30, 1824.

Celtis occidentalis (hackberry),

Urtica divaricata (wood-nettle). Aug. 7, 1821. Mountain. (U. Canadensis, Torrey, Laportea Canadensis, Gray.)

" pumila (buck-weed). Aug. 17, 1821. Mountain. (Adike pumila, Torrey, Pilea pumila, Gray.)

" procera (tall-nettle). Aug. 20, 1821. Wood near Hallowell's &c. (U. gracilis, Gray.)

Pilea glabra. May 19, 1821. St. Martin. (P. Americana, Torrey, var. pubescens, Gray, J. B.)

Cannabis sativa (hemp). July 29, 1821. Common, roadside.

Platanaceæ.

Platanus occidentalis (plane-tree). May 29, 1825.

Juglandaceæ.

Juglans alba (shell-bark hickory). (Carya alba.)

" tomentosa (mocker-nut hickory). (Carya tomentosa.)

" sulcata (thick shell-bark hickory). (Carya sulcata.)

" amara (bitter-nut hickory). (Carya amara.)

" cinerea (butternut). Mountain.

Cupuliferæ.

Quercus olivæformis (bur-oak). (Q. macrocarpa, var. olivæformis, Gray.)

" rubra (red oak).

" coccinea (scarlet oak).

Corylus avellana (hazel-nut). June 22, 1821. Small mountain. (C. rostrata, J. B.)

Carpinus Americana (hornbeam).

Ostrya Virginica (hop hornbeam).

Fagus ferruginea (beech).

Myricaceæ.

Myrica gale (sweet gale). Sept., 1821. Island opposite Point St. Charles.

Betulaceæ.

Betula nana (dwarf-birch). June 9, 1825.

" papyracea (canoe birch). May 11, 1825, and Sept. 11.

" populifolia (poplar-leaved birch). Sept. 26. (B. alba, var. populifolia.)

Alnus serrulata (smooth alder.) July 29.

" undulata (green alder). June 11, 1821. (A. viridis.)

Salicaceæ.

Populus angulata (angled cotton-wood). Sept., 1821.

" tremuloides (aspen). May 10, 1821.

" grandidentata. September 30.

Coniferæ.

Pinus balsamea (balsam fir). May 25, 1821. Savanne. (Abies balsamea, Gray.)

' strobus (white pine). May 25, 1821. Savanne.

" pendula (larch, tamarack). (Larix Americana.)

Taxus Canadensis (ground-hemlock). May 20, 1824.

Araceæ.

Arum triphyllum (Indian turnip). June 16, 1821. Papineau Wood.

Symplocarpus fœtidus (skunk-cabbage). Salisb.

Typhaceæ.

Sparganium simplex (bur-reed). July 23, 1821. Meadows near Gregory's.

" ramosum. June 29, 1821. Lachine Wood, et aliis.

Typha latifolia (cat-tail). July 24, 1821. Savanne.

" vulgaris. Sept. 11, 1821. Boucherville Islands.

Lemnaceæ.

Lemna polyrrhiza (duck-weed). Sept. 8, 1821. Common.

Naiadaceæ.

Potamogeton compressus (pond-weed). July 29, 1824.

" fluitans. August 14, 1821.

" lucens. Sept. 8, '21. River, near Point St. Charles.

" natans. July 23, 1821. River St. Pierre.

" perfoliatus. July 27, 1821. River St. Pierre and Three Rivers.

Alismaceæ.

Alisma plantago (water-plantain). July 23, 1821. Near Gregory's. (Var. Americanum, J. B.)

Sagittaria sagittifolia (arrow-head). July 29, 1821. (Var. variabilis, Gray.)

" latifolia. Aug. 4. At Nichol's. (Var. variabilis.)

" gracilis. July 27. River St. Pierre.

Hydrocharidaceæ.

Vallisneria spiralis (tape-grass). Sept. 8, 1821. River, near Point St. Charles.

Orchidaceæ.

Orchis spectabilis. 1821.

" dilatata. June 11, 1821. Mountain swamp. (Platanthera dilatata.)

" fimbriata. July 23, 1821. Gregory's Meadows, et aliis. (Platanthera psycodes, var. grandiflora, Torrey.)

" orbiculata. June 11, 1821. Mountain-swamp and Portage des Grês. (Platanthera orbiculata.)

Habenaria macrophylla. July 10, 1822. Portage des Grès. (Platanthera orbiculata.)

Satyrium bracteatum. July 5, 1822. Swamp and Rivers. (Platanthera bracteata.)

Neottia cernua (ladies' tresses). Sept. 3, 1821. Côte St. Paul. (Spiranthes cernua, Torrey, J. B.)

Arethusa bulbosa. July 5, 1822. Swamp, Three Rivers.

" ophioglossoides. July 5, 1821. Swamp, Three Rivers. (Pogonia ophioglossoides.)

Calypso borealis. May 25, 1822.

Cymbidium pulchellum (grass-pink). July 14, 1821. Savanne. (Calopogon pulchellus.)

Atalaxis liliifolia. July 14, 1821. Savanne. (Liparis liliifolia.)

Cymbidium odontorhizum. July, 1822. Papineau Wood. (Corallorhiza odontorhiza.)

" corallorhizum. June 4, 1821. Savanne. (Corallorhiza innata.)

Cypripedium arietinum. June 4, 1821. Savanne.

" humile (low ladies'-slipper). June 2, 1822. (C acaule.)

" spectabile (gay ladies'-slipper). June 25, 1821. Mountain-swamp.

" pubescens (yellow ladies'-slipper). June 4, 1821. Savanne.

" parviflorum (small yellow ladies'-slipper). June 4, 1821. Savanne.

Iridaceæ.

Sisyrinchium anceps (blue-eyed grass). June 11, 1821. Common in fields. (S. Bermudiana, J. B.)

Smilaceæ.

Smilax peduncularis. June 25, 1821. Mountain.

Trillium grandiflorum (wake-robin). May 14, 1821. Gulley at Tanneries, Mountain, &c.

" pictum. May 26, 1821. Papineau Wood. (T. erythrocarpum, Michaux, Gray, J. B.)

" cernuum.

" erectum. May 15, 1821. Papineau Road.

Medeola Virginica (Indian cucumber). June 11, 1821. Swamp, Mountain.

Liliaceæ.

Convallaria angustifolia (Solomon's seal). May 26, 1821. Papineau Road. (Polygonatum biflorum, Ell., Gray, J. B.)

Convallaria bifolia. June 11, 1821. Mountain. (Smilacina bifolia, Ker, var. Canadensis, Gray, J. B.)
" polygonatum. May 30, 1821. Mountain. (Streptopus roseus. Michaux, Gray, J. B.)
" racemosa. June 17, 1821. Mountain. (Smilacina racemosa, Desf., Gray, J. B.)
" stellata. June 4, 1821. Savanne. (Smilacina stellata, Desf., Gray, J. B.)
" borealis. June 4, 1821. Savanne, et aliis. (Clintonia borealis, Raf., Gray, J. B.)
Allium Canadense (wild garlic), Kalm. July 3, 1821. Island above Nuns' Island.
Lilium Philadelphicum (wild orange-lily.) (L.) J. B.
" Canadense (Canadian lily). 1820. Laprairie.
Erythronium dens-canis (dog's-tooth violet). May 5, 1821. Mountain. (E. Americanum, Smith, J. B.)

Melanthaceæ.

Uvularia grandiflora (large bell-wort). May 15, '21. Papineau Road.
" sessilifolia. May 15, 1821. Papineau Road.
Veratrum viride (white hellebore). July 5, 1821. Three River's swamp.
Tofieldia glutinosa. Cleghorn's, Quebec. June 28, 1827.

Pontederiaceæ.

Pontederia cordata (pickerel-weed). July 27, 1821. Mouth of River Saint Pierre.

Gramineæ.

Zizania clavulosa (Indian rice). July 27, 1821. River St. Pierre. (Z. aquatica.)

Equisetaceæ.

Equisetum arvense (mare's-tail).
" palustre.
" limosum.

Filices.

Polypodium vulgare. August 7, 1821. Mountain.
Struthiopteris Pennsylvanica. July 3, 1822. Papineau Woods. (S. Germanica, J.B.) (Ostrich-fern).
Pteris gracilis. June 15, 1822. Mountain. (Allosorus gracilis, J. B.)
" aquilina (brake). August 2, 1821. Common.
Adiantum pedatum (maiden-hair fern). June 25, 1821. Mountain.
Asplenium rhizophyllum. April 30, 1822. Cleghorn's garden; originally from St. Helen's. (Camptosorus rhizophyllus, J. B.)
" thelypteroides. July 17, 1821. Mountain.
" augustifolium. June 25, 1821. Mountain. (Asplenium Filix-fœmina, J. B.)
Athyrium bulbiferum. June 25, 1821. Mountain. (Cystopteris bulbifera.)
" Thelypteris. Aug. 11, 1821. Gregory's Meadows. (Aspidium Thelypteris, J. B.)
" ———. July 16. (Cystopteris fragilis, Bernh.)
Aspidium dilatatum. Oct. 3, 1820. Papineau Wood. (A. spinulosum, var. dilatatum, Gray, J. B.)
" cristatum. June 16, 1821. Papineau Woods.
" Goldianum. June 15, 1822. Mountain. From Mr. Goldie.
" marginale. June 16, 1821. Papineau Woods.
" acrostichoides. Sept. 18, 1821. Mountain.
" ———. June 16, 1821. Papineau Woods.
Onoclea sensibilis. Aug. 2, 1821. Papineau Woods.

Woodsia hyperborea. August 7, 1821. Mountain.
Osmunda regalis (flowering-fern). August 11, 1821. Wood beyond Gregory's.
" interrupta. June 16, 1821. Papineau Woods. (O. Claytoniana.)
" cinnamomea. June 11, 1821. Mountain-swamp.
Botrychium gracile. June 25, 1821. Mountain (B. Virginicum.)

Lycopodiaceæ.

Lycopodium dendroideum. June 16, 1821. Papineau Wood.
" clavatum (club-moss). July. Papineau Wood.
" lucidulum. Oct. 3, 1821. Papineau Wood.
" complanatum. Woods north of Papineau Road. July 3.

ARTICLE VII.—*Geographical distribution of the Genus* ALLIUM *in British North America.* By GEORGE BARNSTON, Esq.

(Presented to the Natural History Society of Montreal.)

In the October number of this journal enquiry was made as to whether the onion may not be a native of the north or north-western parts of America, and report was made of onions (of course the garden onion) having been brought from a place y'clept "Le Jardin du Diable," situated on the borders of Lake Temiscamingue. The querist surmises, on such grounds, that the onion may be indigenous in the North-west territory; and strengthens his views by a quotation from Sir Alex. McKenzie's voyages, that on the banks of McKenzie's River "there was plenty of wild onions."

Premising, in the first place, that the voyageur understands not exactly the onion of the gardens to be meant, when the term "wild onions" or "oignons sauvages" is used, but any species of the onion that may be met with in the different portions of the country travelled through—in which general sense I have no doubt it was employed by Sir Alex. McKenzie—I shall proceed to shew, as far as can be determined from the labors of botanists up to the present date, what are the various species of the genus *Allium* that have been found on this continent, from the temperate latitudes up to the frozen zone. I shall endeavour to group them also, according to the different districts of country which the species themselves seem to prefer, in hopes that thus a more distinct idea may be formed of their geographical distribution.

The two southern species of the *Allium*, well described by Gray, are *A. striatum* and *A. tricoccum.* The former possesses long linear leaves, striate on the back, with an obscurely triangled

scape; the latter has the leaves flat, and lance oblong. Neither, therefore, can possibly be confounded with the *Allium cepa*, the true garden onion.

Allium cernuum and *A. Canadense*, somewhat more northern species, are also sufficiently distinct. The former has the leaves linear, sharply keeled, a loose or drooping umbel of rose-colored flowers, borne on an angular scape; the *A. Canadense*, well known in this province, has also the leaves linear, and the flowers of a pale rose color.

Allium Schœnoprasum (the Chive) is met with from the shores of Lake Huron and Lake Superior as far as Great Bear Lake in a northerly direction, and along the banks of the streams to the Rocky Mountains, westwards. Douglas and Dr. Tolmie also obtained it on some of the tributaries of the Columbia. It is the only Allium which we discern in this latitude as crossing the whole breadth of the continent, or we should rather say acquainted with the waters of the Columbia as well as of the St. Lawrence. Latterly it has been looked upon as the same plant as the *A. Sibiricum;* in which case we may allow it a still greater extension than Europe and North America, and almost admit that it encircles the globe in the northern temperate zone. Its mode of growth, its deeply colored sepals, and other specific characters, separate it from *Allium cepa* as well as from others of its genus. We cannot but admire the acute discrimination of the botanist, whether Linnæus or another, who first gave the specific name. Whoever has plaited rushes on the springy brae, whether in the form of garters or fools-caps, or baskets for gowans, will admit that he was no goose that gave to Chive its specific name; and whoever has been a year at college will own that there is no language so well adapted as the Greek for giving a combination of ideas in one epithet or term. To resume our subject, we come to our fourth section.

Allium stellatum and *A. reticulatum* (the latter being probably the *A. angulosum* of Pursh) are plants common to the plains of the Saskatchewan, but have been also found, it is said, on the north-west coast. Their non-occurrence on the plateau westward of the Rocky Mountains, between that mighty range and the volcanic ridges of Mounts Rainier, St. Helens, Hood, and Jefferson, may be accounted for by the dryness of that region, the sandy wormwood plains of the middle country possessing an atmosphere in many situations as arid as the steppes of Tartary.

As soon as the descent is made towards the Pacific, where the moist ocean breezes have play, and deposit their humidity, the *A. stellatum* and *A. reticulatum* resume their place in the western flora. They have linear leaves, and are certainly specifically distinct from the garden onion.

Two other species yet remain to be noticed, the *A. acuminatum* and *A. Douglasii.* The former keeps, as far as we yet know, to the north-west coast; the latter is found there also, but has been likewise discovered on the Shoshonee or Snake Indian lands south of the Blue Mountains, an inland district. They both possess rose-colored flowers, and their umbels are loose or patent.

We thus perceive that the species of the Allium or Garlic genus, hitherto discovered in North America, have no more to do with the garden onion than the garlic or chive themselves. Yet when met with by the voyageur they are called, indiscriminately, "oignons sauvages," or, if he speak English, "wild onions." When the boats' crews are grouped together round a camp fire, if any of the party have picked up a few of these savoury little bulbs, with which to regale his mess, a very earnest discussion will sometimes arise as to the comparative merits of the "oignons sauvages." Should one of the crew have ever had the good fortune to handle a spade or weeding-hoe in the gardens of Canada, he immediately becomes the savan of the circle, and after due inspection may, with a grave countenance, pronounce the onions to be *ciboullettes.* If they be small and cylindrical, with hollow leaves, he is actually right, and they are luxuriating on the *A. schœnoprasum.* This is the extent of the voyageur's knowledge of onions; and I believe that the intrepid and persevering Sir Alex. McKenzie merely spoke as a voyager, adopting the phraseology of his canoe-men when talking of these native species. All difference or argument about species is summarily settled amongst voyageurs by the irrefutable conclusion, "Ils sont tous des oignons sauvages."

The scientific botanists, Richardson, Douglas, Drummond, Tolmie, and Gairdner, who traversed the country to the northward, have never given the slightest hint of the *Allium cepa* being a native. Had it been to be met with, it could not possibly have escaped their observation. It is not a plant of the morass or inaccessible mountain: it would have been found with its congeners on the banks of rivers, or in plains where the soil was rich, or fertilized to a certain extent by alluvium. Its discovery as an

indigenous plant of this country would also have been considered as worthy by these men of signal and particular note. But, as far as I know, we have not a word on the subject.

The onion, we are led to understand, has been from remote ages a famed plant, and a highly prized pot-herb. It was cultivated and held sacred by the Egyptians. The Roman satirist exclaims, "Who knows not the superstitions of the crazy Egyptian, that it is with him an impiety to hurt or bite the leek and onion. Oh! holy people, whose gardens give birth to these deities." An Egyptian would take an oath by garlic or onions as he would by his gods.

The Greeks must have held all of the garlic tribe in very high estimation, but in quite a different way from the Egyptians. A philosophizing genius enabled the Greeks to struggle hard against absurdities, and take vantage-ground for the freedom of intellect. They had their *Skorodophagi* or garlic eaters, their *Krommuophagi* or onion eaters, and their *Prasophagi* or leek eaters. We may say, then, that the refined Greeks had, as respects vegetables, a combination of Spanish, French, and Welch tastes.

Among the Romans a love for these bulbs also prevailed, and sometimes to an intense degree, if we put full faith in the expressions made use of respecting them. "*Si porrum et cepe trucidas*," says the Roman gentleman and poet, whose idea is best explained perhaps by the translation: "If thou art devouring the leek and onion." And has not the same roguish *bon vivant* written a whole ode in execration of garlic, because he had partaken too largely of it, as well no doubt as of other good things, at a banquet? The fact appears to be that Horace, finding he had hurt his stomach by a surfeit, humourously clokes his failing, and amuses himself by a philippic against the unlucky garlic, which, coming uppermost, reminded him of his excess. In all likelihood it had only been an ingredient of a dish, and had only lent its attraction to some too luscious dainty. They were accustomed to pound or bruize the garlic when preparing it for the table. "*Pistillo fragrantia mollit allia.*"

The reputation of this genus, being of such preëminence amongst the nations of antiquity, will, I trust, excuse me for having thus enlarged upon the subject. It may still interest some readers to bring together a few opinions regarding the etymology of the botanical name of the onion. Some give the Celtic word *All*, meaning hot or burning, as a derivation for *Allium*; but

whatever may have been the primary root, the Romans, who were much better acquainted with the Greeks than with the Celts, must certainly have taken the word from the Greek, *Aglis*, which in the plural, *Aglites*, was the term used for the root or cloves of the garlic. We find the *g*, which was omitted by the Romans, still retained in its soft form by the Italians in their word for the same plant, *Aglio*. In French it becomes *Ail*, in Spanish *Ajo*, and in Portuguese *Alho*. This accordance in name may lead us to infer that either the Romans themselves introduced the garlic into their western provinces, or that it had been perhaps taken there before their conquests by Greek mariners, who would have the cloves or root on board their vessels, both as an article of food for themselves, and for traffic with the natives. Garlic was an indigenous plant probably in Lower Egypt, as well as in the islands of the Eastern Mediterranean.

Cepa, the specific name of the onion, and by which it was known separately by the Romans from the Allium or garlic, has the appearance of a Greek extraction also; *Kephalis* being the term applied to the head of flowers, prevailing in all the plants of the kind. The *Keph* becomes *Cep* from the softening of the consonant before *e*. The modern Italian here also approaches nearer the Greek than the Latins did, and we have *cipollo* in Italy at the present day, instead of *cepa*. The Celtic *cep*, meaning a head, may be the primary root; and, if we rely on this etymology, the onion or *cepa* may be considered to have derived its name, either from having been looked upon as the principal of its kind, or from possessing the most perfect capitulum or head of flowers. Its habitat was probably more extended than that of garlic, passing perhaps from the Mediterranean islands into northern Greece. A good European flora would shew if this supposition were correct.

The Gothic and Saxon races do not seem to have followed the Latins in their names for these vegetables; but, adopting their own word, *Lœk*, *Look*, or *Lauch*, as a general term, affixed to it some other word denoting what appeared most characteristic in the species they wished to particularize. The leek or *prason* of the Greeks, the *porrum* of the Romans, and *poireau* of the French, was familiar to them. Instead, therefore, of introducing the soft language of the south, they vigorously applied the firm articulations of their own tongue in combinations, to express new ideas, or name new objects as they presented themselves. This rule has not held, howeve in the case of the shallot, which,

being probably of later introduction to the northern countries of Europe than others of its genus, and only cultivated in the gardens of the rich, kept amongst the Germans the southern name given to it unchanged.

In closing these observations on the onion or garlic genus, and returning to the point of enquiry first touched upon, I can say that my own belief is that the onions from the banks of the Temiscamingue Lake, if really garden onions, must be descendants of some that have been cultivated on that spot by the Jesuits, or perhaps some shanty-men or intelligent Indians once located there. In these old Jesuit gardens, flowers of Europe have been found perfectly naturalized, which must have been first introduced by the early pioneers of civilization. These floral bequests, after nearly one hundred years of neglect, have still, by the favor of nature and advantageous situation, kept their solitary hold, beautiful mementos of the pursuits and recreations of the most intelligent of the first enterprising settlers in the land.

ARTICLE VIII.—*On the Generation of Sounds by Canadian Insects.* By GEORGE GIBB, M. D., M. A., F. G. S., Member of the Canadian Institute, &c.

(Presented to the Natural History Society of Montreal.)

Among the most striking peculiarities associated with the study of insect life, which very early attracts the attention of the young entomologist, are the various musical or other sounds and notes which are emitted by many of the genera among the different families of this division of the animal kingdom. In my youthful days I used to listen with an exciting interest to the tuneful song of the Tree-hoppers, *Cicadæ*, in the extensive gardens of Mr. James E. Campbell, my maternal grandfather, situated at the foot of the Current St. Mary, on the beautiful Island of Montreal. I watched whence the music proceeded, and stopped not until my curiosity was ultimately rewarded with the capture of one of these insects, which have been celebrated from time immemorial, and described by Virgil as rending the bushes with their song:

> "Et cantu querulæ rumpent
> arbusta cicadæ."

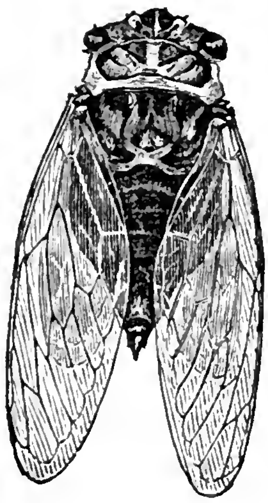
The insect sang as it was held between my fingers, and it was from the possession of this specimen that my taste for collecting insects at an early period was formed. It was not long subse-

quently to this that a fine large beetle of a fawnish-drab colour, the *Monohammus confusor* * rewarded my efforts, and the utterance of a very delicate, but still quite audible squeak like that from a mouse, only not so loud, astonished me very much. This sound continued for hours, whenever the beetle was disturbed, notwithstanding a pin had been passed through one of the elytræ. As my collection increased, many other beetles were discovered to emit similar sounds of varying intensity. But the loudest and most striking note of this kind given forth by an insect, was from a very beautiful and rare species of sphinx, the *Sesia Pelasgus* or Humble-bee Hawkmoth, and although my collection numbered but one similar specimen given to me, I retained the one which was captured by myself for some time alive to hear its murmurs.

The sounds generated by Canadian insects were never disregarded in my entomological rambles, and it is with a view of drawing the attention of my younger readers to this interesting subject, that I venture to put together a few remarks, which shall embody a brief description of the sounds, and an enumeration of the principal insects which produce them. And here I must be excused for a moment, if I refer back to that period of youth, when all is sweet and joyous, when neither thought, nor care troubles the mind, and nought interests for the time but the ardent pursuit after the studies of nature. It is with feelings of ever cherished recollection that my mind dwells upon my rambles and their connecting incidents over the various parts of my native island, which, perhaps, are agreeably forced upon one during a sojourn in another and a distant land. My insect collecting days are not likely to be resumed in this country, and with a view to preserve the records of my early labours, the great bulk of my collection is now deposited in the Museum of the Literary and Philosophical Society of St. Andrew's, in Fifeshire, the country from whence my paternal ancestors came.

Of the Canadian insects which emit sounds, unquestionably the most remarkable is the *Cicada* or Tree-hopper, which sings loudly during the hot months of summer, and in some localities, especially in large gardens, and groves of bushes, exists in great numbers. Its shrill chirping may be heard during the greater part of the day, when the sun is shining, and the insect may be found sitting on the leaves or small branches of trees, or occasionally on the fences, in all of which situations I have captured them.

* Common in August about the Wood-yards of the city.—Eds.



Tree-hopper. *
(Cicada canicularis.)
Natural size.

Drums of Tree-hopper.
a a the outer drums; *b* the muscular strings; *c c* the inner drums.

This insect is not a grass-hopper, as its name is erroneously translated from the writings of Pliny and others, but belongs to the first family of the Homopterous Hemiptera. It has a pair of transparent wings and wing covers, and a shining black body; the largest Montreal specimens measure 3 inches and 3 lines with extended wings, and the body 9 lines and-a-half. Their general expansion is from $2\frac{1}{2}$ to $3\frac{1}{4}$ inches, and the veins of the wings are of a green and orange colour. They are not found in such large numbers in Canada as in the United States, where it is said such immense numbers are sometimes congregated, as to " bend and even break down the limbs of trees by their weight, and the woods resound with the din of their discordant drums from morn to eve." On the most careful comparison between the Canadian and European species of this insect, I find there is not the slightest appreciable difference in the formation of the musical instrument or particular organ, which is present in the males only on each side of the base of the abdomen, by means of which is produced a sort of monotonous and noisy music, which has led to their being termed by many authors " chanteuses " or singers.

It consists of 2 pairs of large plates fixed to the trunk between

* Several species of *Cicada* inhabit the United States and Canada. The Larvæ live under ground on the roots of trees to which they are occasionally injurious. Dr. Harris in his treatise " On Insects injurious to Vegetation," gives an interesting history of the above and several other species.—Eds.

the abdomen and hind legs, these form a large exterior moveable cartilaginous curtain or membrane, which, when raised, exposes a cavity, part of which seems to extend into the abdomen, and part to be covered with a second thin and pellucid membrane, much more delicate than the exterior one, and tensely stretched, plicated, and iridescent. In the middle there is a horny plate running horizontally across the bottom. It is this iridescent membrane which is acted upon internally by a bundle of muscular strings which throw it into rapid vibration, and thus gives rise to the sound. These minute muscular strings are attached by one extremity to another membrane in the interior, which is presumed to be the true drum, from the fact, that when Réaumur*, who is describing the mechanism of the sound produced, compares it to that issuing through an opening like that of the larynx of quadrupeds, or the sound-hole of a violin.

This most curious apparatus has attracted the attention of many of the most celebrated physiologists, and a desire is manifested on the part of some of them to know whether any actual difference exists in its construction in *Cicadæ*, existing in other parts of the world besides Europe. As Greece and Italy are the two countries in which it abounds, the familiarity with its history evinced by Anacreon, Aristotle, Pliny, Virgil, and some other ancient authors is fully explained. There can be no doubt that Aristotle refers to the Cicada, when he speaks of the voices of insects, especially of "a shrill, long-drawn note, like the grass-hopper." Pliny speaks of the Cicada, but there is no doubt that he, as well as Aristotle has confounded grass and tree-hoppers together.

Whether the sound is pleasing to the ear is a question; assuredly when it proceeds from a number, its shrillness and frequent repetition becomes fatiguing. I cannot say that it was displeasing to myself, perhaps because my curiosity was amply repaid by its capture and examination of the insect, and because I wondered, in common with others, that such a shrill and loud sound should proceed from such a small creature: its music being more audible than that of many birds. In the forests of South America at certain periods of the day nothing is heard but a loud and uninterrupted rustling or humming noise, produced by various insects, in which the notes of the Cicadæ predominate. Kirby and Spence mention on the autho-

* See Cuvier's Animal Kingdom 1849, page 569 for a more minute and strictly anatomical account.

rity of Captain Hancock, that the Brazilian Cicadæ, sing so loud as to be heard at the distance of a mile, which is as if a man of ordinary stature possessed a voice that could be heard all over the world. That its voice is very much louder than our Canadian species, may very well be understood, when it is remembered that the Brazilian Cicada is a much larger species, and I am informed that its drum is similar to the one which has been described. The use of the music, as in crickets, and other insects, is for the the purpose of attracting the female sex, and it conclusively shows that if the precise organ of hearing has not been definitely recognized in them, it at any rate is most assuredly not absent. Newman has observed, "to what purpose would the merry cricket sing his evening song, if there were none of his kind to listen to and admire it?"

Any one who has walked across a Canadian meadow or pasture land, in the summer time, or over a hay field, particularly after the hay has been cut and removed, must have observed the countless numbers of grass-hoppers, locusts, crickets, and other insects, which hop across his path, and produce with their united voices a chirping noise not easily forgotten. Some of the locusts possess yellow wings with a black border, and as they fly, produce a sort of loud snapping noise, which is very peculiar.* This is produced by the attrition of the anterior pairs of wings against each other, one of the nervures being furnished with a rough file-like edge, which is made to pass over the nervures of the opposite wing; and the sound is augmented by the resonance of a certain part of the wing, that is surrounded by peculiarly strong nervures, between which the thin membrane is tightly stretched, so that it acts as a tympanum or drum. In other species of Canadian locusts there exists on each side of the body near the base of the abdomen, a large cavity, closed on the inside by a very thin pellicle, which has some influence in the production of chirping, or possibly as has been supposed in flight. It is in this respect analogous to the tree-hoppers, and may be compared to a kind of tambour or drum. The opening left by the pellicle, which answers the purpose of a lid, is crescentic in shape, and at the bottom of the cavity may be seen a white membrane shining like a mirror

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* This insect is called the Rattling Locust *Ædipoda sulphurea*, and possesses dusky elytræ. I have noticed the wings vary in colour, but the yellow are the commonest with a black border.

and tensely stretched. The apparatus as described by De Geer, may be seen in the second volume of the Pictorial Museum of Animated Natnre, page 340. Fig. 3389.

Many varieties of the grass-hopper and locust may be captured in the gardens and fields, and of a considerable size; some of them are destitute of wings, but all are capable of making their own peculiar noises. In a case of South American insects once in my possession there is an immense brown bodied locust, whose extended wings measure 7 inches, the length of the body being 4 inches. It is an example of *Acrydium Latreillei*, the upper wings are green and the lower deep red, bordered with brown, the legs green.*

The noise of the flight of an immense swarm of these locusts in South America has been compared by Mr. Darwin to a strong breeze passing through the rigging of a ship. The noise occasioned by whole armies of locusts, by the mere act of mastication alone, when incalculable millions of powerful jaws are in action at the same time, has been likened to the crackling of a flame of fire driven before the wind.

The Canadian student will be well repaid, by collecting all the varieties of the locusts and grass-hoppers, which abound on the Island of Montreal.

As belonging to the same family as the locusts and grass hoppers, may be mentioned the Canadian crickets, the males of which call their females by making a chirping noise, produced as in many of the grass-hoppers by rubbing the inner part of the wing-covers like a talc-like mirror, against each other with rapidity, and sometimes by a similar alternate motion of the hind thighs against the wings and wing covers, the thighs acting as part of the bow of a violin. The last I suspect is the common practice with crickets, whose song is heard with so much regularity in the night time. The number of chirps uttered I have counted with my watch, and find it to be 76 per minute, the standard of the healthy pulse, but if any noise be made, the chirps increase to 100, very seldom more. The field cricket *Gryllus compestris*, is of a black colour and may be heard in the fields at all periods of the day, where they may be found of all sizes hopping about. The song of the house cricket, *G. domesticus*, is to be heard in every well

* This magnificent case, containing about 250 specimens of exotic and other insects, many of great rarity and beauty, I presented to the Literary and Philosophical Society of St. Andrew's.

regulated Canadian hearth in the evening or twilight, and although it is said not to be so soft as the song of the mole cricket, which I have never met with in Canada, it is by no means disagreeable, although I must confess it is sometimes rather harsh Opinion varies on the "vulgarly called song of these animals," for I find Milne Edwards, of whom I had expected better things, calls it a sharp and disagreeable sound, which explains the origin of their vulgar name of *cri-cri.* The author of the "Backwoods of Canada," is also evidently no admirer of the *Gryllus*, for she says—"The very crickets, that used to distract us with their chirping from morning till night, have forsaken their old haunts." But this is excusable, for a sad inroad was made by these insects into the fair author's clothes and woollens. To study the habits and song of the Canadian cricket, a good plan would be to keep a number in cages, as practised by the Spanish peasantry, who delight in its querulous chirping.* Among many people the chirp of the domestic cricket is considered a good omen, and its absence from a French Canadian hearth produces some anxiety. Although not influenced by anything of this kind, I do entertain a partiality for the cricket's chirp, which I have been accustomed to hear with satisfaction from childhood.

All the known species of the *Mantis* are proper to America, but by the species of *Phasma* † which I have captured on the slopes and base of the Montreal mountain, I have not noticed that any sound was produced, notwithstanding that some species, as the *Praying Mantis*, are said "to carol forth a fine canticle."

I have observed that many beetles, particularly the large drab with long antennæ (*Monohammus*), emitted a distinct but slight sharp sound, which is attributed to the friction of the peduncle of the base of the abdomen against the inner recess of the thorax, when they alternately enter and withdraw it. The rubbing of different parts of their dense integument against each other, is, however, the general explanation of these sounds in beetles. This may be the case in many of them, but I think there are, in some, true respiratory sounds, that is to say, while at rest sounds are emitted from some of the spiracles which answer the

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* My readers will doubless remember the quarrel between two boys respecting a cage full of crickets, which gave Don Quixote so much annoyance, but which was ended by the worthy squire making a purchase of the chirping brood for four farthings.

(†*Spectrum femoratum ?*—Eds.)

purpose of the larynx in higher animals, when the insect is motionless. In the cock chafer, which soon makes its presence known in the evening, by the noise it makes in flying about a room, the sounds are likely due to currents of air directed to some of the spiracles which exist at the interspace between every two segments of its body, as in common with the other coleoptera.

Lest it might be thought that I had overlooked the sound produced by the *Anobium*, a small beetle that burrows in old timber, I will merely give it the passing notice, that its tick, which has procured for it the name of the *death-watch*, is totally unconnected with the respiratory system, and is produced by rapping its head against the wood work, and if the signal be answered, it is continually repeated. Its noise resembles a moderate tap with the nail upon the table, and this imitation will be answered by the insect, as if the real sound of its own kind. When I first heard the death-watch, I was told it was a very bad sign, and that it portended the dissolution of some relative! The superstitious notions which prevail regarding this harmless beetle, are preposterous, but at the same time have done much mischief. The reader (especially the superstitious one) is referred to the description of the death-watch in Maunder's Treasury of Natural History.

Among the Lepidoptera—the butterflies of which those common to Canada have been so ably illustrated in the pages of this Journal, I have heard a stridulous sound emitted by many species of the sphinx or hawkmoth tribe, captured generally in the evening twilight. This sound is something like the squeaking of a mouse or a bat, and was strikingly pronounced in a beautiful and rare specimen of humble-bee hawkmoth, the *Sesia Pelasgus* with reddish brown wings and hyaline disks, taken in the gardens of Mr. James E. Campbell, at the foot of the Current St. Mary. This squeaking noise continued as long as the creature remained alive, and was much louder than in any other of the numerous sphinges it was my good fortune to capture. It is a well-known fact that when the death's head sphinx, *Sphinx Atropos*,* common to England, is in the least irritated or disturbed, it emits a similar sound, and it is related that from this circumstance, together with the presence of a very large patch, exactly resembling the usual figure of a skull or death's head on the top of the thorax, it is held in much

* A very perfect specimen is in the Museum of the Natural History Society, presented by the writer.

dread by the vulgar in several parts of Europe, its appearance being regarded an ill omen, or harbinger of approaching fate. With the Death's-head moth, this sound is given out when confined or taken into the hand, and is likened to the cry of a mouse, but is said to be more plaintive and even lamentive.

The humming noise of many, if not of most of the Canadian sphinges, some good specimens of which were in my collection, is distinctly heard during their rapid flight, but it is again different from the stridulous and plaintive note emitted by them when stationary. The mode in which this sound is produced has not as yet been correctly ascertained. It has been supposed by Reaumur to be caused by rubbing the palpi against each other, and by Lorey to be owing to the rapid escape of the air from the two ventral cavities. On carefully considering the matter, there cannot be any doubt that the sound is connected with the respiratory organs, but in what manner it is produced, will probably never be ascertained. I have no doubt if attention is paid to this point, that one or more of the Canadian species may be found to emit the sound *before* quitting their pupa-case, as Mr. Raddon found with the Death's-head moth.

Although it is not always easy to detect the mode of production of the sounds generated by different tribes, we have no difficulty in rightly attributing the buzzing and humming noises heard during the flight of the dipterous and hymenopterous insects, to the forcible expulsion of the air as it streams through the respiratory spiracles. The experiments of Burmeister on bees and flies show that the noises are not so much produced by the simple motion of the wings, to which it is commonly attributed, as by the vibrations of a little membranous plate, situated in each of the posterior spiracles of the thorax; for if the apertures of these be stopped, no sound is heard, even though the wings remain in movement. These are the true vocal organs, although the full-toned buzz is increased by the action of the wings; yet many of the species, as the wasp-fly for instance will buzz when at rest.

The buzzing of the gad-fly *Tabanus* is familiar to horses and cows*, which are sometimes covered with blood from its attacks. The shrill trumpet of the musquito gives us warning of the proximity of that insect, which pursues us in many parts of Canada, thirsting for our blood. The buzzing of numerous flies, including

* The horse gad-fly *Gastrus equi*, whilst that affecting sheep is called *Oestrus ovis*, or the sheep gad-fly.

countless blue-bottles; the humming of bees, the shrill buzzing of wasps, and the creaking sound of the sawyers, are, I presume too well known to need description. The last of these is the *Tenthredo cerasi* so destructive to many of the fruit trees of North America, and the sound produced by its sawing efforts is entirely mechanical. So also is that of the timber-louse, *Atropos pulsatorius*, which in this respect resembles the death-watch, but belongs to the Neuroptera, and reminds me that the same family includes the celebrated *Termes* or White ants. Ants belonging to the Hymenoptera are well known as domestic pests, from their ravages some times in the well-stored cupboard; and when a swarm of them is dispersed, the only sound emitted for so unceremoniously driving them away, is a distinct and audible kind of a hiss.

I trust this slight sketch of the generation of sounds of insects, heard for the most part on the Island of Montreal, may prove not only of interest, but be the means of drawing attention to the subject. Many of them are not only exceedingly shrill, but can be heard at a considerable distance, and with every propriety the organs producing them in nearly all the insects which have been noticed, may be considered as the analogues of the larynx and trachæ in the higher animals. I am of course at issue with the immortal Cuvier on this point, as he has remarked that the various noises made by insects are in reality *not* the voice; because, he says, the air does not pass through a larynx. If the numerous spiracles are for the purposes of respiration, a fact indisputably established, and that the air is known to rush in and out of some of them, then they are the analogues of the larynx, and simulate its functions, as much so, as the circulation in insects is the counter-part of the same function in the vertebrata. And I will close with the question of Pliny on this subject, who asks—"And where too, has nature implanted that sharp, shrill voice of the creature, so utterly disproportioned to the size of its body?" to which I reply, that in the majority of insects, it is in the spiracles, or representatives of the larynx in higher animal life.

London, September, 1858.

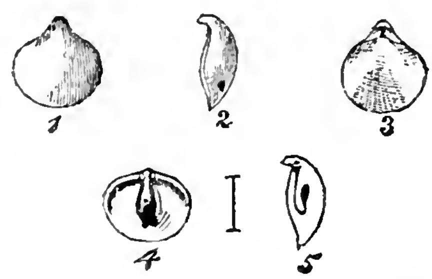
ARTICLE IX.—*On some new Genera and Species of Brachiopoda, from the Silurian and Devonian Rocks of Canada.* By E. BILLINGS, F.G.S. Read before the Natural History Society of Montreal, 28th March, 1859.

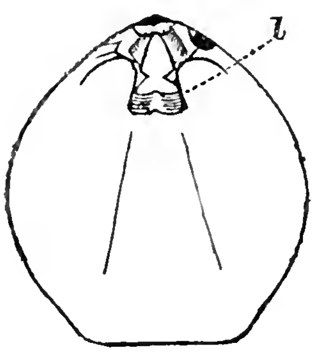
(*From the Report of the Geological Survey for* 1858.)

Genus CENTRONELLA, Billings.

Generic Characters.—Shells, having the general form of *Terebratula.* Dorsal valve, with a loop consisting of two delicate riband-like lamellae, which extend about one-half the length. These lamellae at first curve gently outwards, and then approach each other gradually, until at their lower extremities they meet at an acute angle; then becoming united they are reflected backwards towards the beak in what appears to be a thin flat vertical plate. Near their origin each bears upon the ventral side a single triangular crural process. Name from the Greek, *Kentron,* a spur. This genus is intermediate between *Terebratula* and *Waldheimia.* In the former the loop is short, not exceeding greatly one-third the length of the shell and not reflected. In the latter it extends nearly to the front and is reflected but the laminae are not united until after they are folded back.

The following figures will explain the difference more clearly:





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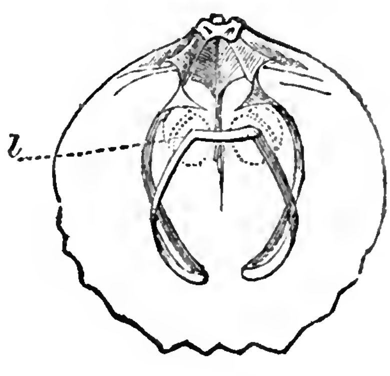

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Figs. 1, 2, 3. Ventral, side, and dorsal views of *Centronella glans-fagea.*

" 4. Interior of dorsal valve, shewing the loop.

" 5. Longitudinal section, shewing the position of the loop in the interior.

" 6. Interior of dorsal valve of *Terebratula.* *l*, the loop.

" 7. Interior of *Waldheimia.* *l*, the loop.

CENTRONELLA GLANS-FAGEA, (Hall, Species.)

Rhynchonella glans-fagea, Hall. Report of the Regents of the University of the State of New York, 1857. Page 125.

Description.—Shell, small, smooth, broad oval or rather sub-rhomboidal, greatest width near the centre of the length of the dorsal valve, from which point the sides slope in nearly straight lines to the beak where they meet at an angle of about eighty-five degrees; front rounded or sometimes either a little pointed or slightly sinuated. Ventral valve the larger, its outline forming a nearly regular arch from the beak to the front margin, strongly and broadly subcarinate along the centre, beak very prominent and projecting over the dorsal valve at a right angle but not much incurved at the point; an open foramen beneath it. Dorsal valve somewhat flat, a wide shallow concavity extending from near the beak to the front where it gently elevates the margin of the ventral valve. Length from two to four lines, width about the same.

This little species is somewhat variable in form, the length being sometimes greater than the width, and often a little less. The broad shallow mesial depression of the dorsal valve sometimes extends nearly to the beak, and in other specimens dies out at two thirds the length. The detached dorsal valves also exhibit two very thick and strong supports for the loop and between them a deep fissure open to the beak.

Locality and formation.—Oriskany Sandstone, near Cayuga, C. W. Corniferous limestone at Rama's farm, near Port Colborne; abundant. In the State of New York it occurs in the Schoharie Grit.

Genus STRICKLANDIA, Billings.

Generic Characters.—Shell, usually large, elongate oval, transversely-oval, or circular, sometimes compressed; valves nearly equal; a short mesial septum in the interior of the ventral valve supporting a small triangular chamber beneath the beak as in *Pentamerus;* in the dorsal valve no longitudinal septa spires or loop, the whole of the internal solid organs consisting of two very short or rudimentary dental plates, which in some species bear prolonged calcified processes for the support of the cirrated arms. In all the species the ventral valve has an area more or less developed.

This group of shells, although closely related to *Penta-*

merus, differs from that genus in the following particulars:—1st. In *Pentamerus* the form is globular and the ventral valve is much the largest. In *Stricklandia* the valves are nearly equal and never globose. 2nd. In *Pentamerus* the dorsal valve has two or three longitudinal septa, which in some species sustain a small triangular chamber. In *Stricklandia* these characters are entirely absent. It might be thought that the difference between the short or rudimentary dental plates of *Stricklandia* and the elongated mesial septa of the dorsal valve of *Pentamerus* is not of sufficient importance to constitute a generic distinction, because it is only a difference in the extent to which identical parts are developed, the dental plates of the former genus being a rudimentary state of the septa of the latter. When, however, we examine any group of closely allied genera we find that all the grounds for separation consist in the various modifications of the same set of organs. Were it not so then there would be no such thing as homologous parts. The difference in the degree of the developement of an organ is not *always* a good character, but when it is carried to such an extent that the whole form of the animal is affected in a particular manner, manifested in a number of species then it becomes of generic value. If we take the several species of *Stricklandia* and compare them with an equal number of species of *Pentamerus*, such for instance as *P. Knightii*, *P. galeatus*, *P. Sieberi*, *P. acutolobates*, *P. caduceus*, &c., the difference in the external form of the two groups is so remarkable that we would be almost warranted in separating them into two genera upon this ground alone; but when to the dissimilarity in the general form we add the difference in the internal structure then there can be little doubt as to the correctness of the separation.

This genus includes three English species which have been long known under the names of *Pentamerus lens*, *P. liratus*, and *P. lævis*. All these, and the three Canadian species, abound in rocks of the age of the Middle Silurian, such as the Landovery rocks of Sir R. Murchison, and the Clinton and Niagara groups of the New York geologists. No species have as yet been found either above or below the Middle Silurian. On the other hand, the genus *Pentamerus* occurs more or less frequently in all formations from the Black River limestone* to the Devonian inclusive.

* I have ascertained that *Atrypa hemiplicata* (Hall) is a true *Pentamerus.*

The following figures exhibit the difference in form between *Stricklandia* and *Pentamerus* :—

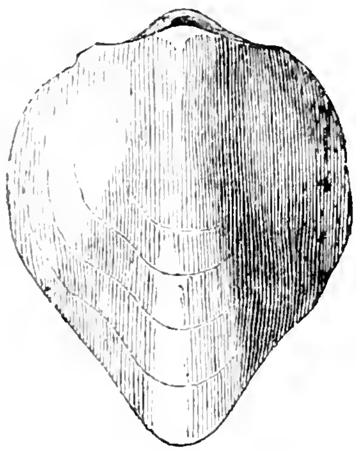

Fig. 8.

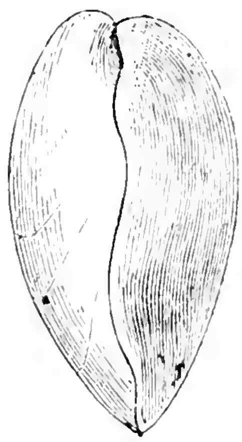

Fig. 9.

Fig. 10.

Fig. 8. *Stricklandia lens*, dorsal view.
" 9. do. do., side view.
" 10. *Pentamerus Knightii*, side view.

I am not certain whether Fig. 9 is the true *S. lens* or a variety. It is more pointed in front than any of the English specimens that I have seen.

STRICKLANDIA, GASPÉENSIS, Billings.

Description.—Shell, large, oval; length to breadth about as five is to four; valves about equally convex. The ventral valve has a shallow mesial depression which commencing at the beak in a point gradually enlarges to the front margin, more than half of which is affected by it; the dorsal valve has a corresponding mesial elevation, on each side of which there is sinus of just sufficient strength to induce the idea of a trilobed surface. The two valves are nearly equal, the ventral being the longest by about one line in a specimen five inches in length. The beak of the ventral valve is closely incurved over that of the dorsal and on each side of it there is a short area. The whole surface is covered with strong close rounded longitudinal ribs with rather sharp furrows between. These ribs are on an average one line wide at the front margin.

This species, differs from all the others in its form, which is a nearly perfect ellipse, both ends being about equally rounded and the greatest width being in the centre of the length. The ribs are also more distinctly defined and proportionally more numerous than these of any other species.

The average length is four inches; width three inches and a half; depth of both valves two inches and a half.

Locality and formation.—L'anse à La Vielle. Gaspé Upper Silurian.

STRICKLANDIA CANADENSIS, Billings.

Description.—Shell very large, sub-circular, transversely broad, sub-oval, often much expanded, compressed, surface covered with rather obscure radiating ribs. The form is somewhat variable. Usually the hinge line is straight and two thirds the greatest width of the shell, the cardinal angles rounded, sides gently convex and the front slightly pointed; the ventral valve with a mesial sinus commencing at the beak and gradually enlarging to the front; the dorsal valve with a corresponding mesial fold; both valves about equally compressed convex; radiating ribs obscure one line in width at the front. Average width of adult specimens five inches, length the same or a little less, depth of both valves one inch and a half.

The proportioned length and width varies. In some specimens the sides are so gently curved as to become sub-parallel and in such instances the length is a little greater than the width, but in general the latter dimension is the greatest.

This species closely resembles *S. liratus*, and may perhaps be considered a variety thereof, but at present on account of its great size, I think it a distinct species.

Locality and formation.—In great numbers at Mr. Goodenow's Quarry, near Thorold, C.W., in the Clinton limestone.

(Var.) STRICKLANDIA BREVIS, Billings.

Description.—Transversely oval, rather convex, hinge line a little more than half the width of the shell cardinal angles, sides and front rounded; surface covered with obscure rounded radiating ribs from half a line to one line in width. Mesial fold and sinus obscure width from two inches to two inches and a half; length from one inch and three fourths to two inches.

This form is closely allied to *S. Canadensis* but is proportionally broader and more convex. The fossil figured in the Palaeontology of New York, vol. 2, p. 22, fig. 3, under the name of *Spirifer* —appears to be the same.

Locality and formation.—South West Point, Anticosti, Middle Silurian.

ARTICLE X.—*On the Variable Illuminating Power of Coal Gas;* by WILLIAM E. A. AIKIN, Prof. Chem., &c., University of Maryland.*

(Read before the American Association for the Advancement of Science, at the Baltimore Meeting, May, 1858.)

IN common with a large number of our citizens, my attention was directed some short time since, to a somewhat sudden, inexplicable and enormous increase in the amount of our quarterly bills for gas consumed; an increase equal at times to an advance of a hundred per cent over the corresponding quarter of the preceding year. As it would have been absurd to suppose a simultaneous derangement of all the meters over an extensive district, it was obvious that the difficulty could not lie in any error in the registry of the gas, but in its illuminating power, necessarily requiring the consumption of a greater bulk of gas to produce a given quantity of light. Feeling curious to know how this difference could have occurred, I set myself to work to ascertain, if possible, what causes could be acting to diminish the illuminating power of the gas.

It has long been known that the quality of the gas produced from the fat coals is very materially influenced by the circumstances of the decomposition. In the elaborate experiments made some years ago, on a most extended scale by Hedley, the British Engineer, as detailed in his report to a committee of the House of Commons, we find this subject most satisfactorily discussed. Below a cherry red heat the products obtained by heating coal in close vessels contains hardly any illuminating material. At that temperature it is furnished most freely, but after having been formed is liable to decomposition, involving a loss of carbon by contact with any highly heated surface in passing through the apparatus. Such decarbonization increasing with the degree of heat, with the extension of the red hot surface, and with the time of contact. Again, the duration of heat is most important, the best gas coming over during the first hour, the quality rapidly deteriorating, until at the expiration of four hours the product is worth very little to the consumer, and after five hours may be considered as worthless. But the bulk of such worthless gas that can still be obtained by pushing the process to completion is very considerable, equal sometimes to $\frac{2}{5}$ of all that passes over.

* Cited from Silliman's Journal.

How far any neglect in the observance of the precautions required to produce a proper illuminating gas, may explain the result the public have no means of knowing. All that we know is that the manufacturers furnish an article which they say is the right article and prepared in the right way, and possessing an illuminating power varying from 14 to 17 candles. That is, their engineer reports, that on trial with a photometer, at stated times, the gas burning from a jet, consuming five cubic feet per hour, gives an amount of light equal in the average to that of 15 patent candles six to the pound. The patent candle being ostensibly a mixture of spermaceti and wax. Assuming as true all that is claimed by the manufacturers, it can still be shown that the gas even if properly made and correctly tested may be and is furnished to the consumer in a condition of greatly diminished illuminating power, compelling the consumption of a greater bulk to obtain the required light and consequently swelling the record of the meter and the sum total of the quarterly bills. In my trials to determine the specific gravity of our gas by weighing a globe previously exhausted and then filled with it, I obtained a result ranging from 570 to 580 somewhat below that given as characterizing good gas. But in reality I attach very little importance to this result since the mere specific gravity of such a complex mixture as coal gas can hardly be relied upon to determine its commercial value.

Although good gas certainly has a higher specific gravity than poor, yet the difference could not be taken to represent the true difference in value since the principal components of the mixture hydrogen, carbonic oxyd, light carburetted hydrogen, olefiant gas and other still heavier hydrocarbons having specific gravities, widely different, might vary somewhat in their relative proportions sufficient to affect the illuminating power, without at the same time and to the same extent affecting the specific gravity. The action of chlorine in removing the olefiant gas and other more dense hydrocarbons, the principal light giving materials of the coal gas, showed a per centage of these substances never exceeding 10 per cent. But not having time at the moment to guard against all sources of error in the process, laid it aside. My attention was principally directed to the simple inquiry to what extent will the illuminating power of the gas be impaired by keeping it in contact with water for noted periods. That it does deteriorate when thus kept, or when kept in contact with oil or even close vessels has been long known.

Dr. Ure tells us that gas from oil when first made and with a specific gravity of 1·054 will give the light of one candle when burned from jets consuming 200 cubic inches per hour. But keep the gas three weeks and then to get the same light from the same burner you must supply 600 cubic inches per hour. He adds that with coal gas the deterioration appears to be more rapid. For if such gas when first made will give the light of one candle by the consumption of 400 cubic inches per hour, when kept four days will require the consumption of 460 cubic inches per hour to give the same light. My first attempt to obtain some definite results began on the evening of the 8th ultimo, when I filled a a large receiver from the street main and placed it on the shelf of the pneumatic trough, the next evening I filled a second one and put it alongside of the first, the following evening I filled a third receiver, and still the following evening, the 11th inst., I filled a fourth receiver. On the evening of the 12th I was thus provided with four jars of gas, one of which had been standing 24 hours or one day over the pneumatie trough, this I will call No. 1; another, No. 2, had been standing two days; No 3 had been standing three days, and No. 4 had been four days in contact with the water. The diminution in volume by such exposure was indicated by a receiver graduated to cubic inches into which I introduced 130 cubic inches of gas on the evening of the 8th; on the evening of the 12th this had lost about 10½ cubic inches, indicating a loss of about 8 per cent. of the original bulk.

The effect produced on the illuminating power of the gas by the loss of volume became at once apparent as I proceeded to contrast the value of the flames furnished by the contents of the several receivers, 1, 2, 3, and 4. I used for this purpose the ordinary photometer arrangement, taking the relative intensity of the shadows produced, as a measure of the relative intensity of light. The candle employed for the comparison was the patent candle already referred to, and the burner was the kind known as fish tail burner, which had been previously guaged, and known to consume a trifle more than 5 cubic feet per hour with the average maximum pressure of the gas works. I need hardly add that the burner was the same in all the trials, and occupied exactly the same position. The burner and the screen on which the shadows fell were not moved at all during the experiments. The only adjustment wanted was to bring the candle nearer to or father from the screen, and by beginning with the most luminous

gas the adjustment became simply a gradual withdrawal of the candle.

The capped receiver from which the gas was passed floated freely in a large glass jar, supported in an erect position by the perpendicular sides of the jar, its own weight, with all attachments, making a difference of level between the water around it and that within equal to 3½ inches, a little exceeding the ordinary evening pressure in the gas pipes. This difference of level, and consequently the pressure on the escaping gas, was kept uniform by the spontaneous sinking of the receiver as the gas was consumed, a flexible tube communicating between the stop of the receiver and the gas burner. This arrangement gave me a steady, equable flame, which continued perfectly uniform long enough to enable me, after a few trials, to note, very exactly, its true value. The results as first obtained were too startling to be at once believed, but subsequent repeated trials satisfied me that they were very close approximation to the truth. The first trial was with the gas from the street main, which I found equal to 10·71 candles. The same gas, transferred from the pipe to the capped receiver, and burned immediately, gave exactly the same power, 10·71 candles. Gas No. 1 was next used, and found equal to only 3·50 candles; Gas No. 2, after standing two days, gave the light of 3·20 candles; Gas No. 3, three days old, was equal to 1·90 candles; and Gas No. 4, four days old, gave the light of 1·75 candles—these quantities representing the average of repeated trials.

It thus appears that the illuminating material of our coal gas is so rapidly abstracted by suffering it to remain in contact with water, that the same volume of gas which to-day will give me the light of nearly 11 candles, by standing until to-morrow will give the light of only 3½ candles, and if left standing four days will give the light of only 1¾ candles, while the only means left to the consumer to get the light he requires from this deteriorated gas is to burn more of it, as we have all been doing through the past winter. If we now take into account the well known fact that gas of less illuminating power has less density, and that gas of less density passes more rapidly through a given aperture than gas of greater density we have another cause operating to increase the consumption. In Hedley's experiments the Argand burner which gave the light of 25 candles when supplied with 3 cubic feet per hour of gas from Welsh cannel coal, with a specific gravity of

737, required no less than 7½ cubic feet per hour to give the same light, from the same burner, when the gas was made from the Newcastle coal and had a specific gravity of only 475.

Again, as we diminish the illuminating power of the gas we increase its heating power, and this necessarily brings with a higher temperature given to the burners, a higher temperature given to the gas passing through them, and again an increased repidity in the flow. It is thus manifested that the public placed in a peculiarly unfortunate position, since all the mistakes that are likely to occur in the process of manufacture are mistakes that must inevitably increase the bills of the consumer and the profits of the manufacturer. If the workman fails to raise the heat with proper rapidity, if he overlooks a retort and allows the heat to continue a little too long, if towards the close he allows the heat to rise a little too high, the result is inevitable, the product is deficient in illuminating power. Or if on any one day a little more gas is produced than is legitimately required, the surplus remains in the gasometer to vitiate the supply of to-morrow. To what extent this vitiating action operates may be inferred from the fact that I have never been able to obtain from the gas of our pipes an illuminating power equal to the minimum of that reported by the engineer of the gas company. In my trials the power has varied from that of 13 candles down as low as that of 9 candles, instead of ranging from 14 to 17 candles.

This difference is perfectly intelligible if we assume the last quantities to represent the value of the gas when first made, and my results to represent its value as delivered to the consumer.

In conclusion I would merely add that the difficulty suggests its own remedy. And that would be to have a standard of quality established by the proper authorities, taking the illuminating power as the basis of the calculation, and then to have the requirements of such standard insured by a nightly examination, if necessary on the part of some one entirely disconnected with the manufacture. In other words the photometer can be made as available and as valuable to the consumer of gas as the hydrometer is to the spirit merchant; as he distinguishes with his instrument in any mixture, between the spirit he wishes to buy and the water he is unwilling to pay for, so the consumer of gas can distinguish with the photometer between the true illuminating material and the worthless heat producing gases, hydrogen and lihtg curburetted hydrogen, that make up the bulk the ordinary coal gas.

MISCELLANEOUS.

Inauguration of the New Buildings of the Natural History Society, Cathcart Street, Montreal.

The erection of New Buildings for the purposes of the Natural History Society, has long been an object of earnest desire among its members and friends. For two years efforts have been made to dispose of their old premises, which although valuable as property, were yet in many respects very inconvenient. Not, however, till last year was this found to be possible. An offer then presented itself which was considered suitable, and a sale was accordingly effected. A site having been granted to the Society on favourable terms by the McGill College, steps were immediately taken by the Council to procure plans and estimates for a new erection. This was done without delay Our funds not permitting us to indulge in external architectural decoration, a plain substantial brick edifice was thought in the meantime sufficient. Every attention was, however, given that the interior arrangements should be in every way suitable as regards light, space, and access for our Natural History collection and our Annual Lectures. These objects have been secured in the most satisfactory manner, and it is now hoped that this venerable and valuable Society will meet with that encouragement from the citizens of Montreal which it may justly claim at their hands. There was a large attendance of ladies and gentlemen at the opening soiree. The liveliest interest was manifested by all present in the Society's valuable collection, and the utmost satisfaction expressed at the internal arrangements of the building. It is to be hoped that the attention of our wealthy and liberal-minded citizens will now be directed to the improvement and enlargement of this Society's collection. The Library, although containing many valuable volumes, the generous donations of former patrons, yet stands greatly in need of being replenished with works of scientific value published within the last ten years. Gentlemen desirous of promoting the interests of science in this province and city, would therefore materially do so by contributing to the increase and efficiency of our collection of scientific books.

The inauguration passed off most pleasantly. The presence of that distinguished veteran, General Sir William Eyre, and his lady, added much to the interest of the proceedings. Mrs. Bell, with several amateurs under the guidance of Prof. Howe, enlivened the evening with beautiful music. We were glad to see again amongst

us our distinguished scientific guest, Mr. Hall of Albany. His speech will be read with much pleasure and interest. Our excellent President, Principal Dawson, conducted the business of the evening with his usual felicitous urbanity and address. We are happy to find that the removal of the Society to their new building has not only called forth the liberality of our friends to the amount of £400, but also added many new members to our roll.

The President (Principal Dawson) spoke as follows:—The occasion of our meeting here this evening is a memorable one in the history of this Society, and I trust also in the annals of Natural Science in Canada. We have long desired to possess a building suitable for the preservation and exhibition of the large and increasing collection which is to-day, for the first time, adequately exposed to public view. (Applause.) This end we have at last attained, and I desire here, in as few words as possible, to express our obligation to those by whose aid this Society has at length found a fitting local habitation. And first, I may say that the Society owes much to the zeal and activity of its officers; and without derogating from the merits of others, I should expressly mention the Recording Secretary, Mr. John Leeming, the Curator, Dr. Fenwick, and the Treasurer, Mr. Ferrier. We owe, also, an expression of gratitude to several gentlemen not officers of the Society, for aid in the arrangement of the objects in the museum, and more especially to Mr. D'Urban, and to one of our guests of this evening, Mr. Carpenter, who has kindly devoted two days to the proper classification of our collection of Mollusks. I must next refer to the liberal terms on which the University of McGill College has bestowed the ground on which this building stands—terms which exact only that which this Society is at all times most ready to offer, access to its collection, as a means of assisting the studies of our younger naturalists. I may add, on behalf of the University, that it rejoices to have it in its power thus to aid a Society engaged, like itself, in the promotion of liberal education and science. I have next to refer to the kind liberality of the citizens of Montreal, in contributing, by voluntary subscriptions and payment for life memberships, to our building fund, and to the transference to this Society, for the same purpose, of the the balance in the hands of the Committee for the American Association. For the rest, we have expended in the same manner the proceeds of the sale of our former building, including, of course, the amount of the bequest of the late Rev. Mr. Somerville. The building has cost about $10,000, and we shall probably have

remaining upon it a debt of about $2,000. It is very desirable that we should be freed from this burden, and our only hope for this is the continued bounty of our friends, which we trust still further to stimulate by the offer of life memberships, giving a substantial interest in the Society in exchange for contributions to its building fund. It might be supposed that after so large efforts on our part, we might successfully urge claims on the Legislature for a grant from the public funds; but we have learned from experience that Government regards the scientific tendencies of the citizens of Montreal as in no need of its fostering care. To other cities, smaller it is true, and less wealthy, liberal grants have been made for scientific purposes; but our independence has been fully acknowledged, in the past year, by the non-payment of even the pittance of £50 per annum formerly accorded. I would not have it understood that we wish to approach the Legislature as a pauper institution. With our present building, collection and membership, and with a self-supporting journal of our proceedings, supported by the enterprise of a Montreal publisher, we are in a position to say that we can faithfully apply for the benefit of Canadian science any means placed within our reach, and can even, as in the case of the grant for the meeting of the American Association in Montreal, treble such sums by our own contributions of means and effort; still, if we receive no such aid, we are content with the advantages derived from our position in this great centre of population. (Cheers.) Natural History teaches us that it is by no accident that the greatest and most prosperous city of British America is placed on the Island of Montreal. In its situation half-way between Cape Race and Ford du Lac; at the confluence of our two greatest rivers; opposite the great national highway of the Hudson and Champlain Valley; at the point where the St. Lawrence ceases to be navigable for ocean ships, and where that great river, for the last time in its course to the sea, affords a gigantic water power; at the meeting point of the two races that divide Canada, and in the centre of a fertile plain nearly as large as all England; in these we recognise a guarantee for the greatness of Montreal, not based on the frail tenure of human legislation, but on the unchanging decrees of the Eternal, as stamped on the world that he has made. (Applause.) We know, from the study of these indications, that were Canada to be again a wilderness, and were a second Cartier to explore it, he might wander over all the great regions of Canada and the

West, and, returning to our mountain ridge, call it again the Royal Mount, and say that to this point must the wealth and population of all this new world flow. It is not worthy of a city so placed to solicit mere artificial dignities; but it is worthy of it to promote within itself all those high moral and intellectual influences which should flow from it to the region around. (Cheers.) Although, therefore, this Society is not for Montreal alone but for Canada, and, as far as may be, for the world; yet, if it should rest for its support on this city alone, we know that, with the kind blessing of the Providence that has given us this goodly heritage, and with that support, cordially and liberally as it is always given to every deserving institution, we may hope to take a high place among the learned Societies of the western world. (Cheers.)

Sir William Eyre, said:—It was not without some considerable hesitation, that I accepted the proffered honour of addressing you on this occasion. I believe it is one of the essential requisites to addressing the public, to be well acquainted with the subject on which you are to speak, and in this respect I confess my deficiency. However, I feel emboldened and encouraged by the indulgence of a Montreal public, which has borne before the garrulity of an old soldier with admirable patience. (Applause.) And, although possessed of no scientific lore, I hope I have sufficient intelligence to appreciate attainments, to which I have myself no pretension, and sufficient feeling to respect and reverence the great *Savans*, who undoubtedly deserve the honour of being classed among the benefactors of mankind. What greater or nobler task can be assigned to genius, than that of diffusing truth and enlarging the sphere of our knowledge, and this not for the sake of mere amusement or the gratification of curiosity, or for the sake of being esteemed a little more knowing than others—objects not worthy of our ambition. But the leading advantage of the cultivation of science is this, that it is impossible or nearly so, to cultivate the faculties of the mind, and to enlarge the understanding without, at the same time, improving the heart, so as to make us better men, better husbands, better fathers, better neighbours, and better citizens, because we thereby get something interesting to think, and to talk about, instead of talking of and against each other. (Applause.) Those who have turned their attention to such subjects, know the pleasureable emotions which spring up within us, as we advance in true

knowledge. Those emotions are among the noblest of our nature, and in proportion as they are cultivated, the heart becomes softened and humanized. Those who once imbibe a relish for such pursuits, turn away almost instinctively from those grosser pleasures, which degrade mankind. There may be exceptions, but that is their general result and tendency. Some there are who think that human nature is only acted upon by considerations, which have self for their object. I think such philosophers are mistaken. They do not see the whole of the truth. They forget that man is made in the likeness and image of his Maker. Every man, however low and humble may be his position, is conscious of possessing something noble in his nature, which at times will respond to high and noble considerations. And if sometimes, why not always? Why should not such occasional visitations become the habit of the man? Nor is the pleasure of intellectual pursuits confined to the *literati* or to any particular class. There are a few in every class who can relish and appreciate such enjoyments. And if a few, why should not many? Even the benefit of a few is a sufficient inducement to generous minds to cause them to labour in the cause of humanity, but the aim of a large philanthropy will always be to convert the few into the many. (Applause.) I was much impressed with some things which came under my observation while travelling in Greece. Though always aware, that the modern Greeks resembled the ancient Greeks, their progenitors, in many respects, and that at all events, they were remarkable for their intelligence, I was not prepared to find what I did find on one or two occasions —the poor Greek peasants, but recently emancipated from the galling yoke of Turkish oppression, as they reposed under the shade of their olives, poring over the pages of Xenophon and Herodotus. (Applause.) Yet such was the case. They seemed perfectly aware of the *prestige* which had once hung, like their own mountain mist, over their beautiful land. They knew well the glorious height from which their race had fallen, but contemplating the glorious deeds of the past, and perhaps, dreaming of a glorious future, they seemed to forget the poverty and wretchedness of their present position. (Applause.) So too, in my own profession, many would be surprised if they went into the barrack-room, and saw the description of books that were to be found in the hands of not a few of the soldiers. Some are apt to fancy that the poor soldiers, the humble, but faithful servants

of the crown, have no relish for intellectual pursuits. The world gives them credit for courage and fortitude—and those qualities were well exemplified on the bleak and dreary *plateau* before Sebastopol, where the soldiers, though suffering every sort of misery, half clothed, half fed, over-worked, and almost emaciated, yet never flinched from their duty, but were always ready to meet the enemy. (Cheers.) All this the world gave them credit for, but it is not so generally known that many of them have minds cultivated to a degree far beyond what you would expect in their position. They have as keen a feeling and relish for what is great and noble as have any of our prosperous civilians. (Applause.) Returning then to the point from which I set out let me say that I think such institutions as this, which has for its object the searching out of truth and the diffusion of knowledge, are of real benefit to mankind, and that those who take a prominent lead in them deserve to stand high in the estimation of their fellow-men. It is a pleasing thing to those who take an interest in Canada to find that the people of Montreal, its principal city, give so warm a support to institutions of this kind. Montreal is already a great and flourishing city, and is every day growing in commercial importance. Its citizens are rapidly becoming wealthy and taking their place among the merchant-princes of the world. Its buildings are rising in all directions and casting their shadows over this splendid stream, which not only connects Canadians with the ends of the earth, but unites them among themselves, more effectually than any political union could do, and it can boast of that stupendous bridge, which, as an unrivalled work of art, is attracting the attention of the world. All this is subject of proud congratulation to the citizens o Montreal, but it is also right and fitting that they should shew to the world that, while not neglectful of material interests, they have minds which can appreciate subjects of a higher order, and that, while they know how to acquire wealth, they know also how worthily to spend it. (Loud cheers.)

Principal Dawson then introduced Professor Hall of Albany, whose reputation as a naturalist, he said, was not merely American, but world-wide. (Cheers.)

Professor Hall said:—I have been somewhat reluctant to accept the invitation to address this assembly, feeling quite unfit to do so, as I have been indisposed for several days, and I am afraid I am quite unprepared to say anything likely to interest

you. But, coming from the United States, where you believe or at least are wont to say we are in advance of you in natural science, it would be a great gratification to me, if, by appearing here on this occasion, I could give any encouragement to a society like this, having for its object the advancement of natural science—a study to which I have devoted 30 years of my life, with scarcely a thought of anything else. It is always very gratifying to me to meet an assembly of persons who are engaged in advancing, or who are doing anything to advance the cause of natural science. With us in the United States any organization of societies for the advancement of natural science reaches but a little way into the last century. A few years prior to the commencement of the present century, a few gentlemen, meeting in Philadelphia in the back office of a druggist's store, organized the Philadelphia Academy of natural science, which is now a most flourishing institution, possessing the largest natural history collection of any society in the United States. I believe about the same period the society which now bears the name of the Albany Institute was organized. At Albany we have three societies, having objects different but yet closely related the one to the other. We have one organized for the advancement of natural history, another for agriculture, another for arts and manufactures, and when we look to our records, we find that all kept equal pace in improvement. There the cast-iron ploughshare was invented, and improvements in that art on which we all depend for our subsistence went hand in hand with discoveries in natural science. The organization of our agricultural societies dates from almost the same period as the organization of our natural history societies, and the improvement of agricultural engines has kept pace with the progress of science. In other cities too of the United States, we have societies formed for the advancement of natural science in all its departments. Your society had a more recent origin, and you can give good account of the years of its existence by what it has already done. Your collections are already very important, and I am enabled to say so from a close personal examination, this not being the first occasion that I have seen them. You have already brought together very valuable materials to form the nucleus of that more extensive collection which would fully represent the natural history of entire Canada. And, as I have observed from the remarks of your president, you are fully alive to the advantages in this respect of

your geographical position, accessible alike from the sea-board, from the South, and from the West, so that with you the formation of a cabinet of natural science in all its departments would be a matter of comparative ease. All that is necessary is that the spirit which engages your interest in this society should be sufficiently pervasive to enlist the services of a sufficient number who shall devote themselves to the interests of science. That their names should be famous ought not to be their object. With the man who cultivates science, truth as manifested in nature should be the object of his devotion, himself entirely forgotten. Therefore, if you would advance science, forget yourself. However much or however little you may contribute to its treasures, never allow yourself to be prominent. Every intelligent person can do something in this way. If his time or means do not permit original investigation, he can contribute to collections. Every one can do that, and every little goes to build up the great mass. We should all contribute something towards building up the temple of science, so that those who come after us may acknowledge that those who went before them did not live in vain. (Applause.) There is one point which you can more readily appreciate than we in the United States, because you are more directly connected with our parent country. It is a new country which we inhabit, which we are filling with the fruits of civilization, and on whose soil we are fixing ourselves, establishing homes like those which we or our forefathers left on the other side. We have here too a new soil—not only a new country but a new soil, clothed with a vegetation entirely different from that we left across the Atlantic. Natural history embraces this soil and all its products, and not only the soil but the rocks from which it is derived, the plants and trees which it grows, and the animals which roam over its surface. Man at his beginning on the earth had nature made subservient to him, and we still are unable to subsist without those means which were more spontaneously supplied by nature to our early parents. Man depends for his subsistence on surrounding animals and plants, and he is unable to live separate or apart from them. Man is not a separate and individual creation, made to subsist separately. But the point I am coming to is this. We have brought from the other side of the Atlantic our domestic animals and fruits, on which our forefathers were fed and nourished. We bring them and plant them on this soil, and just in proportion as we know the character of

this soil, of its underlying rock formations, and of these rocks, in the same proportion do we advance in civilization, which is the great object of our life here, next to that of preparing ourselves for a better. But on this earth we cannot separate ourselves from the domestic animals around us. We have brought with us from across the Atlantic those to which we and our forefathers have been accustomed, and they too must subsist upon the food which is grown upon their native soil. And strange to say we see these imported plants driving out the natural weeds, which leave the soil and give place to the grass and seeds of Europe. The plants of Europe indeed often travel faster than the white man himself, The solitary traveller, making a trail across the great prairies of the West and over the Rocky Mountains, drops on his course the seeds of European plants, which, taking root and springing up. begin to supplant the native weeds, and thus prepare the way for the immigration of the white man. We are carrying on a process of rooting out which is necessary for our own existence. We are removing from the face of the earth, first the men who preceded us, next the animals, and then the vegetation, and introducing in their stead along with ourselves the domestic animals of Europe, and the vegetation on which they feed, and even at the same time the numberless insects which accompany that vegetation. In these circumstances it becomes a population like that of Canada or that of the United States to study more closely than those of Europe, the character of our soil and its products, and it may be necessary occasionally to present this view to shew that the cultivation of natural science is not merely a pleasant and delightful occupation, enlarging our sphere of knowledge, and improving our intellectual faculties, but that it is fitted to improve also our physical condition and to enhance our physical comforts. (Applause.) I am glad to be able to congratulate you on the advances you have made in natural science. It is one of the most pleasant duties of my life anywhere and everywhere in the United States to bear testimony to the advances which have been made in natural science in Canada. If you will allow me to digress for a few moments, I would call your attention to your own geology, to the particular *substratum* from which you derive your soil. You have wrought out here most admirably, by accumulating zeal, by intelligence, and by persevering labour, a knowledge of a set of *strata* which to this day are but little known in Europe. Your knowledge of your Laurentian rocks is far in advance of anything

known in Europe of rocks of the same age. These are not primary rocks. They have been called so. But here in Canada you have the merit of having first pointed out to the world that they are stratified rocks, that they have been laid down by water, that they shew beds of lime and sandstone laid down by water, but modified by subsequent changes. (Applause.) The knowledge of this, of the age of these rocks, of their stratified formation, and of their valuable minerals, is due to Canadian research. You have demonstrated, moreover, the stratification of another set of rocks, called here the Huronian, which had always formerly been thought to belong to the supposed primary chaotic mass. You have then your Laurentian and Huronian rocks, lying at the foundation of your geology, as monuments to your attainments in geological science. (Applause.) Then, with reference to the fossiliferous rocks, you have already done so much, that I cannot attempt to go over the ground. In the Trenton limestones, a Canadian has brought to light those beautiful stone lilies which grow in groups or forests beneath the sea. Your Anticosti too has furnished us with new light in geology. The gap between the Upper and Lower Silurian groups which we have been endeavouring in vain to fill up, you have extended to many hundreds of feet, teeming with the remains of ancient life. Again, it just now occurs to me that while we in the United States have been talking of fucoids, and trying to give names to fragments of plants that we found stranded among our *strata*, it is you who have set us right. One of your number, the President of this Society, found us drifting out to sea upon sea-weeds, and has brought us back, shewing that we had been dealing merely with rootlets of a plant which belongs to the Devonian period in all its course from its beginning to its end. This is another point in which in Canada you are far in advance of other geologists. (Applause). I do not wish to depreciate what has been done by my friends among ourselves on the other side, but these are certainly most encouraging steps which have been taken here in the progress of geological investigation—and those I have mentioned are not all. If I had time I could particularize many more. If, for example, I turn to the economical results of your Survey—for we must go to the soil or to the rocks for our economic materials everywhere and always—then I feel bound to say that you have done more than all our naturalists put together. (Applause.) We have not in any of our collections such a variety of economic

materials as you have here collected in Montreal. In the few years that Canada has been making progress, its progress has been great, and if any feeling akin to jealousy could spring up in my mind, it would be the fear lest Canada, in point of scientific attainments, should in a few years distance us on the other side. In my lessons in geography, as a school-boy, some quarter of a century ago, I remember that we read of Canada as being almost a wilderness, and that it was principally known for its exports of lumber and fur. (Laughter.) But, if 30 years ago, Canada was only known for her lumber and her furs, in 1851 and 1855, at the London and Paris exhibitions, Canada was known for something else, namely, the abundance of her economic resources, brought to light by the investigations of her geologists. If we look at the records of science during the last fifteen years, I think they will bear out the statement that no state or country on this or on the other side of the Atlantic has made more rapid progress in scientific investigations than Canada has done during that period. (Applause.) I have mentioned only a few of the things you have done, principally to encourage you to go on and do still more. I would urge upon one and all of you to go on building up this Natural History Society as a great centre, where you will not merely accumulate material shewing what Canada can produce, but where you will have a collection in which comparisons can be made in all the departments of natural history, and where the student can go to ascertain the names of the objects he is studying, and to see in what respects he can assist in still further enriching the collection. This is an encouraging prospect, and I would only say in closing—so labour that when your children and children's children come hereafter to look at the records of Canadian science, they may be able to say—" How much has been done by those who have gone before us; let us not be remiss in our duty, but let us go on extending, and still extending what has been done by our forefathers." (Loud applause.)

The meeting then adjourned half an hour for refreshments, and conversation.

The President having again taken the Chair,

Hon. Mr. Chauveau rose and said he felt more than he could express, at being called upon on an occasion like this to address some observations to such an intellectual as well as such a brilliant assemblage. Every one who wished for the advancement of science must feel proud that the Natural History Society of

Montreal had at last succeeded in founding a building like this, which besides answering better than any previous building for the requirements of the Society, would also prove an ornament to the city. He could inform them, on behalf of the educational and literary bodies with which he was connected, that they viewed the erection of this building with the greatest pleasure, and were greatly gratified that at length the labours of the Montreal Natural History Society had met with such a reward as was witnessed in the opening and inauguration of this hall. He was one of those who believed that the material progress of a community depends principally upon its intellectual progress; and he thought this was the general opinion. When such was the fact the inauguration of this building ought to be regarded by the community as an event of no common occurrence. He had been glad to hear that the names of Canadian men of Science and their labours were so well known and appreciated in the United States, and he was certain that the audience would listen with renewed interest to the names of a few Canadian scientific men, names it would not be out of place to recall on an occasion like the present. (Applause.) Hon. Mr. Chauveau then read the following brief biographical sketches:—

Michel Sarrazin, Royal Physician and Correspondent of the Academy of Science, appears to me to have been the person who occupied himself most with Natural History in Canada. He was a native of Nuyts, in Bourgoyne. His skill as a surgeon was proverbial. In 1700 he wrote an anatomical description of the beaver, which was read in 1704 by Pitton Tournefort; also, in 1721, his anatomical description of the muskrat. It appears that so far he had had the modest sum of 600f., " without any reward from those whom he served," because he was " the only doctor in the whole country." The Dictionary of Natural Science, 6th vol., says that his work is the most complete in existence. He also employed his attention with other animals. The academy demanded from him information on the botany of the country, and I have reason to believe it was this that led him to discover Sarracenea Canadensis. He died at Quebec in 1734.

Gauthier, also a physician at Quebec, was known to have greatly occupied himself with Botany. Of him I have nothing better to tell than what Bibaud has already said.

The Marquis Galissonniere (Governor from 1747-49) appears also to have attended very much to Natural History; and Kalm

has told us that in hearing him he believed he listened to the great Linnæus.

Pierre Boucher, of Boucherville, who was Governor of Three Rivers, was equally remarkable for his integrity and magnanimity. He was in the country 30 years, when he was deputed to go to Louis the Fourteenth. He informs us that the great King was delighted by his frank answers. He had been ennobled, however, before that period. In 1663 he published a True Natural History of New France (Canada). Charlevoix said that that work was superficial, yet people like to read it, because it informs them of matters not now known.

Honourable Mr. CHAUVEAU, in conclusion, tendered his personal congratulations to the Society for the success which had attended their efforts, as particularly marked in the inauguration of the building. He resumed his seat loudly applauded.

The PRESIDENT said it was matter for congratulation that they had with them on this occasion some of the earlier members who had to do with the origination of the Natural History Society. He would now call upon Dr. Holmes, as one of those early members, to address the meeting. (Applause.)

Dr. HOLMES said that modesty was a quality which met with, general approbation, and after what they had heard this evening he thought Canada possessed a considerable stock of it. They had been living here for years past under the impression that they had been little known to the rest of the world, and that they had been doing very little to make themselves worthy of being known. But this evening they had the gratification and pride of hearing that they were in several points of view in advance of the whole world. (Cheers and laughter.) He accepted with great pleasure and gratification the statements which Professor Hall had made in regard to this point, and he was sure it had afforded them all great pleasure to hear that the labors of the scientific men of this country were appreciated at a distance in the manner they appeared to be. Dr. Holmes then proceeded to sketch the progress of the Natural History Society from its origin to the present day. It dated back, he said, to about the period when Professor Hall was being taught that Canada produced nothing but lumber and furs. At that time, though they did not make any very great noise externally, he was aware there were a number of men in Canada, who, though placed in unfavorable circumstances for their cultivation, nevertheless fully appreciated

the value of science and literature, and who, though they did not devote themselves to this pursuit, yet derived considerable gratification from them. One of the reminiscences of his youth related to a time when Griffintown contained but a single house, that of Mr. Robert Griffin. That gentleman used to assemble his friends—and he (Dr. H.) as a youth considered it a great privilege to be allowed to be present—to hear recitations of Shakspeare. Now, as recitations of Shakspeare even at this advanced period and in the metropolis of the world could draw large audiences, he thought Canadians were not then so very far back as Dr. Hall's books probably stated they were. (Laughter.) They had even societies at that time amongst them. He belonged to one which had existed before the Natural History Society, and which was styled the Literary and Philosophical Society of Montreal. This Society lasted for a year or two; the members got tired of it, the meetings were not attended, and it was broken up. Some slight collections made by it, however, formed a germ for the subsequent organization of the Natural History Society, which commenced its operations in the year 1827, on the 12th of May. To give it stability, it was determined that one of the leading objects should be the formation of a collection illustrating Natural Science. To one who, like him, had been engaged in originating the Society, it was exceedingly gratifying to witness such a museum as was displayed in this building to-night. (Applause.) The Society met at first in a small room, over a bookseller's shop in St. Paul Street, and remained there for several years until their collection became too large for their room. They then removed to a building—now thrown down—between the Banque du Peuple and the Montreal Bank. They remained there for several years, and then they purchased the building from which the Society had just now removed. At the meeting at which the Society was finally organized on the 16th May, 1827, there were 26 members present. Of these there were now only three living in Montreal—the Rev. Dr. Mathieson, Hon. Judge McCord, and himself. There was one other of these 26 original members who was now living in Upper Canada. Whether there might be others still living, who had left the city, he was not aware. Dr. Holmes proceeded to give an interesting sketch of the subsequent history of the Society, mentioning the names of several of its benefactors, and drawing a comparison between the liberality of the old Lower Canadian Legislature and the strange conduct of the present

Legislature in discontinuing the small grant to the Society. He claimed also for the Natural History Society that it had procured the Geological Survey, the benefits of which had been so strikingly set forth by Prof. Hall. He alluded to his long intercourse with Sir William Logan, as school-mates, as college-companions, and in after life, and passed a eulogy on the services rendered to science by that distinguished geologist, and then, after some further remarks, resumed his seat amidst warm applause.

The PRESIDENT said that, before the proceedings closed, he had one or two other remarks to offer. In reference to the Legislative grant, he had just received a note from the Corresponding Secretary, who said :—"The Legislature has not withdrawn its grant, but has neglected to send it." Perhaps there was a difference there by which the Society might hereafter profit. He had further to state that on Tuesday, the 1st of March, they would commence a course of lectures, to be continued weekly from that day, free to the public. The regular meetings of the Society for business purposes and scientific discussions were held monthly on the last Monday of every month. He hoped the number of members would now be increased, that the efficiency of the Society might be augmented. Already, however, they had in it no small amount of working scientific power. He need only mention such names as Logan and Billings in Geology; Smallwood and Hall in Meteorology; Holmes, Barnston and Kemp in Canadian Botany; D'Urban and Hingston in Zoology; Murphy and King in Microscopy; who were prepared to bring to their meetings every month something they had been doing, great or small, in the various departments of Natural History.

The proceedings then terminated shortly after eleven o'clock.

The Toronto Microscopical Society.

On the 1st of February, 1859, the lovers of Microscopical science in Toronto held a meeting for the purpose of forming a society. At a subsequent meeting the constitution was adopted, and office-bearers elected for the current year.

The following resolution was carried :—

Moved by Wm. Couper, seconded by John McRoberts,—"That a copy of the constitution now adopted, together with a list of the office-bearers of the Society, be forwarded to the *Canadian Naturalist* for publication."

President,—PATRICK FREELAND, Esq.
Vice-President,—THOMAS GARBUTT.
Recording Secretary,—JOSEPH DAVIDS.
Corresponding Secretary and Curator,—WILLIAM COUPER.
Treasurer,—JOHN McROBERTS.

Constitution of the Toronto Microscopical Society.

ARTICLE I.

This Society shall be known as the Toronto Microscopical Society.

ARTICLE II.

Its objects shall be to promote microscopical research, and to collect and diffuse microscopical knowledge and information.

ARTICLE III.

SEC. 1. Any person desirous of forwarding the objects of the Society may be admitted a member thereof, by paying the sum of two dollars annually to its funds, and being elected a member according to Article IV. of the Constitution.

SEC. 2. Members shall be divided into four classes, viz: Ordinary Members, Life Members, Corresponding Members and Honorary Members.

SEC. 3. Ordinary Members shall be those who contribute the sum of two dollars annually to the funds of the society.

SEC. 4. Life Members shall consist of Ordinary Members, duly elected, who shall pay to the funds of the society the sum of thirty dollars, or who shall give to the society books, instruments, or microscopical specimens of the value of thirty dollars or upwards. Or of persons who may be elected Life Members by the society at any meeting thereof, for important services rendered to the society.

SEC. 5. Corresponding Members shall be persons residing out of the City of Toronto, engaged in microscopical pursuits, who may be desirous of forwarding the objects of the society, and who shall contribute the sum of one dollar annually to its funds.

SEC. 6. Honorary Members shall be persons eminent for their high standing and attainments in microscopical science, and the number of Honorary Members shall be limited to ten.

ARTICLE IV.

SEC. 1. Any person desirous of becoming an Ordinary or Corresponding Member of the Society, shall signify in writing to the Recording Secretary, such his desire, and deposit with him, at the same time, the amount of one year's subscription.

SEC. 2. He must be proposed as a candidate for admission at a general meeting of the Society, and ballotted for at the next ensuing general meeting, and the proposition of votes requisite for the election of any member shall be three-fourths of the ballot.

SEC. 3. Honorary Members must be recommended for election as such by at least three members, and such recommendation shall be submitted to the council for enquiry, and upon their approval of the recommendation, the person or persons proposed shall be nominated at one general meeting, and be balloted for at the next meeting in the same manner.

ARTICLE V.

SEC. 1. Any member whose annual subscriptions shall remain unpaid for the space of one month after the same shall become due, shall forfeit his claim to all privileges of the Society, and shall not be reinstated therein until he shall have paid all arrears.

SEC. 2. Members leaving the city, may, upon giving notice of their removal to the Recording Secretary, retain their connection with the Society, by paying the subscription of Corresponding Members.

SEC. 3. Members may be expelled from the Society upon the recommendation of the council, and by the vote of three-fourths of the members present at any general meeting.

ARTICLE VI.

The officers of the Society shall consist of a President, Vice-President, Treasurer, Recording-Secretary, Corresponding-Secretary, and Curator, who shall also act as Librarian.

ARTICLE VII.

SEC. 1. The ordinary affairs and business of the Society shall be arranged by the council thereof, which shall consist of the officers and four other Ordinary or Life Members, any three of whom shall form a quorum.

SEC. 2. The officers and other members of the council shall be elected by ballot at the annual meeting of the Society in January each year, from nominations made *vivâ voce* at such annual meeting; and they shall hold office until the general meeting next succeeding the appointment of their successors.

ARTICLE VIII.

SEC. 1. The general meetings of the Society shall be held on the first Tuesday in every month, except the month of January. Five members shall be necessary to constitute a quorum at any general or special meeting.

SEC. 2. At the meeting in January, which shall he held on the second Tuesday thereof, and shall also be called the Annual Meeting, the report of the council for the past year shall be presented, and officers and members of council for the ensuing year shall be elected.

SEC. 3. Special General Meetings of the Society may at any time be called by the Council, or Recording Secretary upon the written requisition of five members, of which meetings six days notice shall be given, and the special business to be considered at such special general meeting shall be specified in the notices calling the same, and no business other than what is so specified in the notices shall be taken up or discussed at such special meeting.

ARTICLE IX.

This constitution or any article thereof may be altered or amended at a general meeting of the Society. But it shall be necessary in every case that notice of the proposed alteration or amendment shall be given at the consecutive ordinary meetings prior to the meeting at which it shall be considered and voted upon.

Note on Mollusks and Radiates from Labrador.

Believing that one useful function of the "Naturalist" is the publication of local lists of species, we insert the following catalogue of specimens, collected on the coast of Labrador by Mr. C. C. Carpenter, a missionary sent to that region under the auspices of a Society in Montreal. They were obtained principally at Esquimaux Bay and other places in the vicinity of the Straits of Belleisle :—

Buccinum undatum—largest specimen 3¼ inches in length.

Trophon (*Fusus*) *Scalariforme*, a specimen an inch and three lines in length.

Rostellaria occidentalis—of rather large size.

Littorina rudis.

L. littorea (*palliata*).

Margarita helecina (*Arctica*).

Lottia (*Tectura*) *testudinalis*—some specimens more than an inch in diameter.

Saxicava rugosa—in *Nullipores*, which seem to be very large and abundant.

Mya arenaria—of very small size.

Solen ensis—large specimens.

Tellina Grœnlandica—abundant, and sometimes highly colored.

Mytilus edulis—Some of the specimens approach very nearly in their ovate forms and strong growth lines to those found in the tertiary clays.

Pecten Magellanicus.

Echinus granulatus—common, and of ordinary size.

Echinarachinus Atlanticus.

Uraster (*Asteracanthion*) *rubens*—one specimen eight inches in diameter.

Uraster ———, a species of which I have no description. The rays are 2½ times the breadth of the disk, less flattened, and with a narrower ambulacral groove than in *U. rubens*. The ambulacral spines are short and cylindrical; the upper part is nearly uniformly and very thickly covered with groups of club-shaped spines, nearly flat at their extremities. The madreporic plate is coarsely marked; the terminal plates of the rays are distinct and nearly annular. Is this the species described by Desor, in Proc. of Bost. Nat. Hist. Soc., as *Asteracanthion Forbesi*. All Mr. Carpenter's specimens have six rays.

Halichondria —Three species, all apparently identical with species found in other parts of the Gulf of St. Lawrence.

Mr. Carpenter's collection also contains *Platycarcinus irroratus* *Balanus crenatus*, and *B. balanoides* (*ocularis*).

REVIEW.

The Master-Builder's Plan; or, the Principles of Organic Architecture as indicated in the typical forms of Animals. By GEORGE OGILVIE, M.D., Aberdeen. London: Longman & Co. Montreal: B. Dawson & Son. Pp. 196.

The study of Zoology in these days requires something more than merely to become acquainted with the names, appearances habits and history of a certain number of animals with their economic uses, and the interesting anecdotes, fabulous or true, which have been related by travellers and lovers of the curious regarding them. It is a serious matter of research to compass the field which this wide and important department of science embraces. A terminology must be mastered as difficult as that which pertains to Chemistry, the most technical of sciences. Anatomy and physiology, with their curious structures and the difficult problems pertaining to their final causes must be encountered; and the department of Homology, which has risen in modern times to vital importance, must be investigated. Comparative anatomy has expanded itself into this latter phase, and aims at obtaining for itself a distinct and generic place in Zoology. Vast as this field may appear it is nevertheless included in the proper and systematic study of animal life. Difficult and profound as many of the questions which it starts may be they are yet perhaps the most interesting, if not fascinating, of any that can engage the human mind. They bring us into contact with mysterious life whose source and destinies lead us to the throne of the Eternal

God; they make us conversant with the multiplex organic forms through which life from its highest to its lowest phases performs its appointed functions in this world; and they invite us to survey the master-piece of the Divine Architect in man, his visible image and likeness.

Of late years, among several others of note, Prof. Owen of London has distinguished himself by his published writings in the department of Homology. In 1848 he published his great contribution to this branch of science, entitled, "On the Archetype and Homologies of the vertebrate skeleton." This was followed in 1839 by his work "On the Nature of Limbs." Lately he has published a concise summary of his views, in a cheap form, in one of the volumes of "Orr's Circle of the Sciences," which is described by a competent critic as a "little book both accurate and intelligible, and almost rendering any popular attempt in the same direction superfluous." The subject has also been philosophically and skilfully handled in McCosh and Dickie's "Typical Forms and Special Ends in Creation," which, to a thinking reader, is really a valuable work. Dr. Ogilvie's book is much smaller and less ambitious than that of McCosh's, and aims at being more popular; and, we may add, more Zoological in its treatment of the theme. The author's great object is, as he states in his introduction, "not to advance new truths, but rather to gain additional currency for such as have a fair claim to be already established, and in particular to convey an idea of the laws of organization to those who, without making natural history a special object of study, may wish to have a right comprehension of its general scope. His style is very perspicuous and vigorous. Every page of the book gives evidence of independent thought and personal investigation. In nine chapters he treats of the various plans on which Animals are formed; of the Vertebrate type and its modifications in Fishes, Reptiles, Birds and Mammals; of the Articulate type, with its relations to the Vertebrate, and its special modifications; of the Molluscan and Radiate types; and of the mutual relations of the leading types of organization. Chapters eight and nine treat of the co-extensiveness of type and design with organic matter, and their bearing on Natural Theology. In the Appendix there is a valuable list of recent and accessible works on the various branches of Zoology. The work is illustrated with many admirable wood-cuts; and altogether it is a most acceptable addition to the student's library of Natural History.

THE

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ARTICLE XI.—*On the Microscopic Structure of some Canadian Limestones.* By J. W. Dawson, LL.D., F.G.S., &c.

[Read before the Natural History Society of Montreal.]

Geology has shewn that over a great part of the earth's surface we can say, almost without hyperbole, "The dust we tread upon was once alive." Great and very extensively distributed beds of rock are of organic origin, made up of the remains of the hard parts of animals, and these often of very minute dimensions. In the bed of the sea, more especially in the coral regions of the Pacific, the Indian ocean and the equatorial Atlantic, such deposits are now manifestly in progress on a large scale; and in the archepelagos of the Pacific, the Bermudas, and the peninsula of Florida, we have examples of these modern formations elevated into land. Similar phenomena exist on a still greater scale in the Tertiary rocks; as for instance in the Nummulitic limestones, extending from the west of Europe almost continuously into India, built up into mountain masses in the Alps, Pyrenees, Carpathians and Himmalayas, and furnishing the materials of the Egyptian Pyramids, and of thousands of humbler structures. In the secondary period, the chalk and many of the oolitic limestones present similar phenomena. Similar organic rocks occur in all the members of the palæozoic series down to the lowest Silurian; and in these earliest periods of the earth's geological history, when organic

life was perhaps young on our planet, the quantity of organic materials thus piled up into rock appears to have been as great as at any subsequent time. Of this some of the silurian limestones of Canada, and more especially the "Trenton Limestone," afford good illustrations, to which I desire in the present paper to direct attention; with the object, not of adding to the knowledge of their fossils, which have been so amply and ably illustrated by Prof. Hall and Mr. Billings, but of noticing the manner in which fragments of these fossils have been accumulated and cemented together into great beds of limestone.

The lowest of the silurian beds of Canada, the Potsdam sandstone, is wholly arenaceus, though with a few fossil remains. The Calciferous sandstone has a greater quantity of calcareous matter and more numerous fossil remains. The succeeding beds, the Chazy, Birds-eye, Black River and Trenton Limestone, are as a whole, of organic origin, and made up of more or less comminuted fragments of shells, corals, and crinoids, occasionally mixed or alternating with deposits of earthy matter. Above these limestones the Utica Slate consists mainly of muddy or earthy matter, and in the Hudson River group there are frequent alternations of earthy matter with organic limestones. It thus appears that in Canada, the head quarters of lower silurian limestone of animal origin, is in the central members of the group, which, according to Sir W. E. Logan, have near Montreal a thickness of nearly four hundred yards, though much thinner in the western part of Canada, as for example in Lake Huron, where Mr. Murray estimates their thickness at only one hundred yards.

Perhaps the most continuous and fossiliferous of all these limestones is that named by the geologists of New York, from an excellent exposure at the waterfall of that name, the Trenton Limestone. It is largely developed in the vicinity of Montreal, and is thus described by the Provincial Geologist, as it occurs in the quarries near the Mile-end road. "In the vicinity of Montreal the lower part of the Trenton formation holds massive beds of gray granular limestone, from which a very large amount of the best building material used in the city has been obtained. The quarries opened on them extend obliquely across that portion of the Côte de la Visitation road, which is southward of the Papineau road, their general direction in respect of one another being about North and South. The beds vary in thickness from three inches up to three feet, and present an aggregate of from

eight to twelve feet. In successive quarries, from the one to the other of which the beds can be traced with considerable certainty, individual beds appear occasionally to change in thickness, a massive one gradually dividing in the strike into two or more, or several thin layers uniting into a solid mass. Slight changes in the color also occur, giving shades of lighter and darker gray."

This gray granular crystalline stone, the texture of which we may see by picking up a chip at any mason's shed in Montreal, is wholly an organic rock, consisting of the hard parts of marine animals, in a fragmentary condition. In some specimens, joints of those curious stalked star fishes, the crinoids or stone lilies, predominate. In others a little branching coral, the *Monticulipora dendrosa* of Mr. Billings, but ranked as a variety of the *Chaetetes lycoperdon* by Hall, is more plentiful. In others, creatures of higher organization than the true corals, the Polyzoa, have contributed countless fragments of a delicate structure, which may often be seen spreading over the limestone in flat branches, marked with little holes or cells like perforations of pins, and belonging to the genus *Stictopora* of Hall,* probably the Ptilodictya of the European Paleontologists. The limestone does not merely contain these organisms; it is made up of them, sometimes entire or in large pieces, but more frequently in minute fragments from one tenth to one hundredth of an inch in size. Its present solid condition is due to clear transparent calc-spar or carbonate of lime, deposited by water in the interstices and cavities of the fragments, like the "congealed water" of Bermuda or the stalagmite of limestone caverns. This substance being perfectly crystalline, has given its own character to the mass, which thus breaks like marble with multitudes of shining surfaces. Under the microscope, however, the true character of the material becomes at once apparent, and the animal fragments, rendered distinct by the remains of their organic matter in a carbonised condition, are seen immersed in the transparent calc-spar, like pieces of potted meat in animal jelly.

To prepare the specimens for the microscope, it is necessary only to select thin fragments, polish them smooth on one side, then attach the smooth surface by any transparent cement to glass, and grind down the opposite side until the limestone is reduced to a

* Especially *S. Acuta.*

thin transparent film. A low power is sufficient to show the general forms and nature of the fragments, but they are often so beautifully preserved as to display their most minute structures when examined with high powers.

With the view of ascertaining whether there is any difference of material in different parts of the beds, I selected from one of the quarries, containing two thick beds with some intervening and overlying thin shaly layers, specimens representing the overlying shaly limestone, the material between the two beds, and the upper, middle, and lower portions of each bed. Duplicate preparations of all these specimens were kindly made for me by Mr. E. Murphy, of this city; and on being examined they afforded the following results :—

1. Above upper bed.—Very small fragments of crinoids and shells with numerous minute and probably young univalve and bivalve shells, in patches in a paste containing black earthy and organic matter.
2. Upper part of bed A.—Principally joints of crinoids; some fragments of corals, especially Ptilodictya and Monticulipora, and shells.
3. Middle of Bed A.—Similar to the last but more corals.
4. Bottom of bed A.—A still greater proportion of Ptilodictya and Monticulipora.
5. Between A. & B.—Crinoids and Monticulipora in about equal proportions, some Ptilodictya.
6. Upper part of bed B.—Similar to last, but still more corals.
7. Middle of B.—Principally Monticulipora and Ptilodictya, but still many crinoids.
8. Bottom of B.—Almost wholly Monticulipora and Ptilodictya.

It thus appears that the only material difference in these specimens is the great prevalence of crinoids toward the top, and of corals and Polyzoa toward the bottom. It is proper to add that, though the families and genera named above largely predominate, there may be detected in any specimen fragments of shells of brachiopods and gasteropods, and of corals of other genera than those named, though in comparatively small quantity.* With the exception of the first specimen, none exhibited more than traces of earthy or acrnaceous matter.

The fine grained earthy limestone, marked No. 1, and which,

* According to Mr. Billings, Cystideans have also been important contributors; but in my examinations their remains are not distinguished from those of the Crinoids.

like the overlying dark limestones, is not used for the more important building purposes, must have been, when recent, a chalky rock, made up of very minute fragments of shells and corals; but it has been blackened by the carbonization of its organic matter, and hardened by the penetration of a calcareous cement; still its general structure under the microscope is not dissimilar from that of chalk. It contains multitudes of minute unbroken shells, some of which have much the aspect of foraminifera, as may be seen in Fig. 1; but they may possibly be univalve mollusks. I

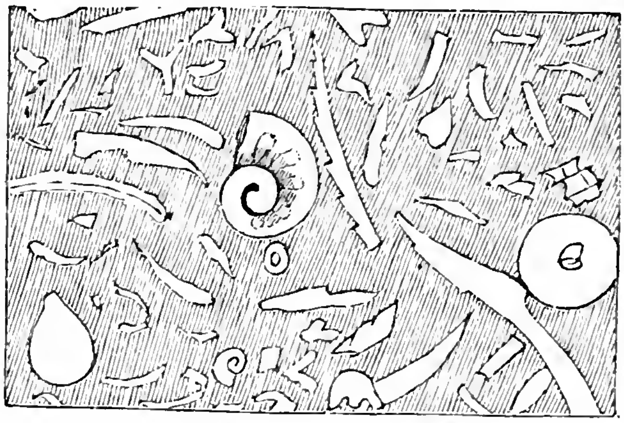

Fig. 1.—*Earthy Trenton Limestone, Montreal,* (20 *diams.*)

hope, however, by the examination of a larger number of specimens, to determine whether minute foraminifera really occur in these ancient beds.

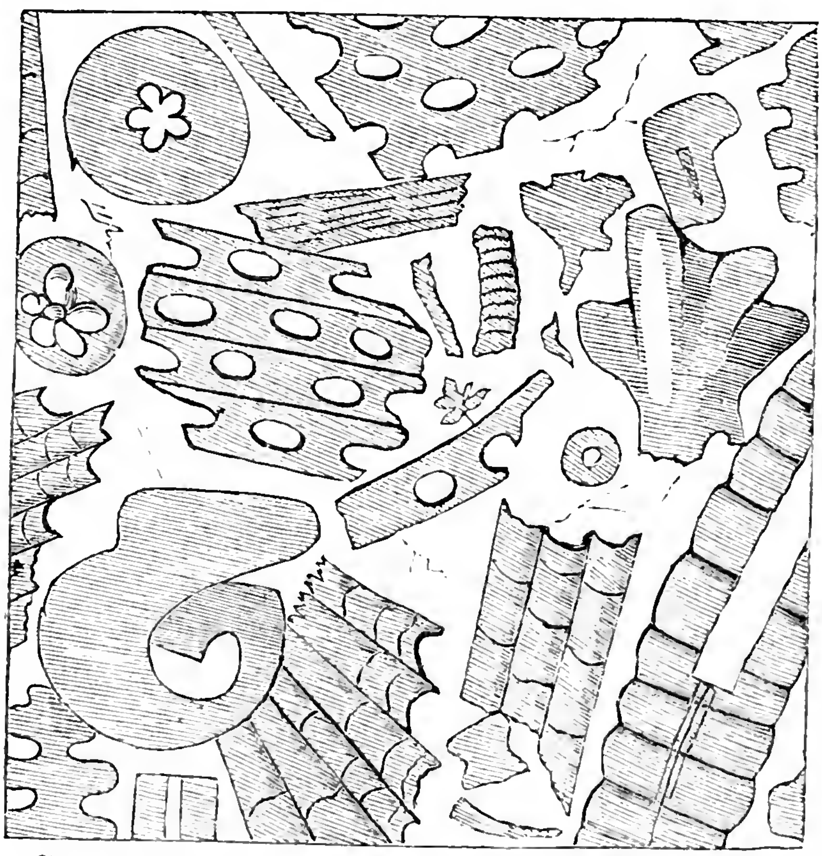

Fig. 2.—*Crystalline Trenton Limestone, Montreal, horizontal section,* (10 *diameters.*)

In the coarse grained variety the materials are somewhat loosely placed, and in a horizontal section like Fig. 2, may appear quite

disconnected, but in a vertical section they are seen to rest upon one another, and sometimes to be very closely packed, as in Fig. 3, in which translucent fragments of crinoids are seen to be

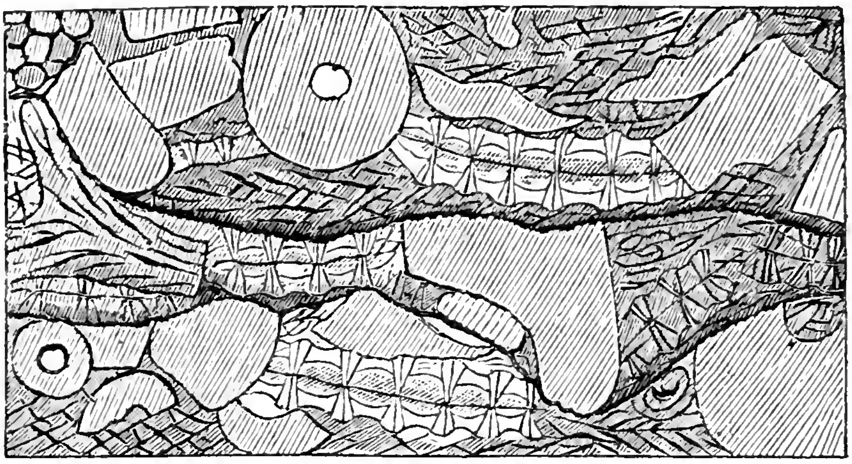

Fig. 3.—*Trenton Limestone, Montreal, vertical section,* (10 *diams.*)

packed in broken corals, chiefly Ptilodictya, and the irregularity of the planes of deposition is marked by two slender bands of fine black earthy and organic slime.

The beds of this remarkable organic limestone are usually very uneven on the surface—the smaller beds very much so; and on these surfaces there often appear quantities of Monticulipora and Ptilodictya in a perfect state, as well as occasionally Brachiopoda, Orthoceratites and Trilobites. Between the beds occurs a black shaly material consisting principally of clay and fine sand, darkened by carbonaceous matter, and containing more or less of fragments of shells and corals. The beds of organic fragments now constituting the gray limestone, must have been drifted over the bottom by strong and apparently somewhat irregular currents, in which in every favorable spot corals fixed themselves and grew. The black shale appears to have settled in the form of fine mud, which often coats over, as with a varnish, the surfaces of the limestone and the fossils lying on them; and which has usually only partially filled up the depressions of the surface, previous to the deposition of a new bed of the grey limestone. In the upper part of the Trenton formation at Montreal, the earthy matter so far prevails that the limestone becomes black and compact, and is interstratified with much shale, but it still contains numerous organic fragments, which in some beds become predominant.

The Trenton and its associated limestones are widely distributed rocks. Their outcrop runs from Quebec along the north shore of the St. Lawrence to Montreal—then southward through the valley of Lake Champlain into New York, where it skirts the Azoic region of the Adirondack, and returning northward along the

valley of the Black river, re-enters Canada at the lower end of Lake Ontario, along which these limestones extend in a broad band, and crossing to Lake Huron stretch along the chain of the Manitoulin Islands, and then run again to the southward along the west side of Lake Michigan. There are also in Canada outlying patches on the Ottawa and Lake St. John. Throughout all these regions the gray crystalline beds are more or less represented; though in the State of New York they appear to be in the upper part of the formation, and to thin out and disappear toward the South.* Specimens from Chateau Richer below Quebec, from Ottawa, from the La Cloche mountains, and from great Manitoulin Island, exhibit very nearly the same microscopic characters with those of the Montreal quarries. In the stone of Chateau Richer crinoids predominate. In that of Ottawa there is a greater prevalence of fragments of shells. In that of La Cloche and Manitoulin the materials are much the same as at Montreal.

The conditions of the accumulation of this great and extended mass of animal fragments, it is not difficult to understand. An ocean area, probably not of great depth, the growth of multitudes of branching corals and crinoids, the destruction of these by the waves and by the death of successive generations, the drifting of their remains by currents over the bottom, the occasional invasion of the clear water by muddy sediment—these are the conditions which must have prevailed when the gray Trenton limestones were formed. Professor Hall and Mr. Billings have remarked that the Brachiopod shell-fish of the Chazy and Trenton are usually of smaller size than that which they attain in overlying formations. This may have been due to the conditions so favorable to the spreading of organic fragments over the sea bottom.

In the Island of Montreal the Black river and Chazy limestones crop out from beneath the Trenton. The quarries at Pointe Claire, worked for the Victoria Bridge, are believed by Sir W. E. Logan to represent principally the former. The western or back quarries on the Mile End road and those of Isle Jesus belong to the latter. The stone worked for the piers of the Victoria Bridge presents several varieties in alternate layers. One of these has the coarse crystalline aspect of the gray Trenton, but it consists principally of fragments of Brachiopodous shells; masses of coral however occurring in some layers. A finer variety which constitutes a large proportion of the stone, is made up of rounded and comminuted

* See Geological Surveys of Canada and New York.

fragments of shells and crinoids, which, like the fragments of some of the modern limestones of Florida, bear evidence of the rolling action of the surf or of strong currents. Another variety is fine and compact like the upper part of the Trenton at Montreal, and shows a homogeneous calcareous and earthy paste filled with fragments of shells, crinoids, and corals. Figs. 4 and 5 represent the

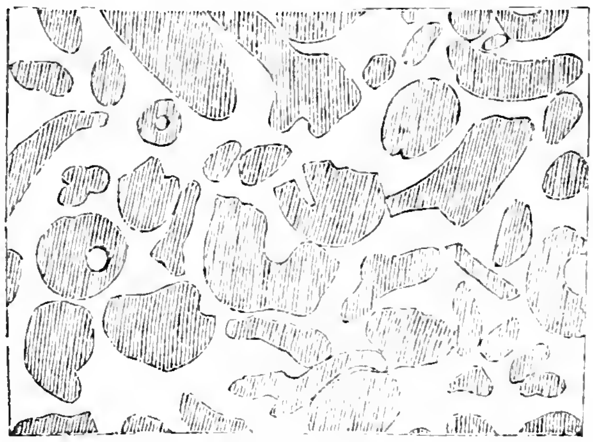

Fig. 4.

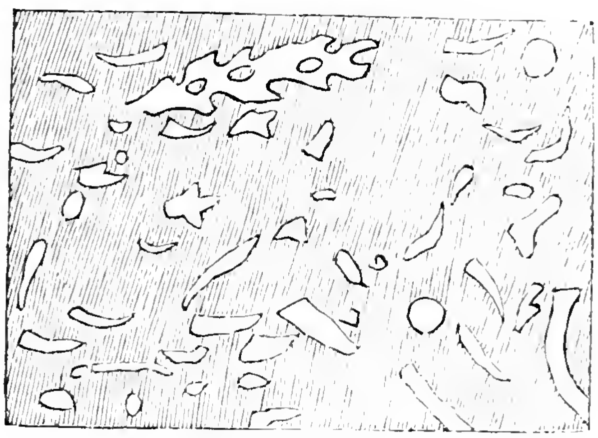

Fig. 5.

Figs. 4 & 5.—*Limestone from Pt. Claire Quarries*, (10 *diams.*)

two last varieties, and may be taken as fair specimens of the material of the piers of the great railway bridge, which solid and durable though they are, are composed of shelly fragments, that once drifted like snow before the ocean currents. The Chazy limestone of Isle Jesus is characterised by Sir W. E. Logan, as "a cemented aggregation of organic remains." I have not examined this stone, but that of the same formation in the vicinity of Montreal, consists almost entirely of broken brachiopodous shells, many of them probably the Atrypa plena, which is so abundant in these same beds. (Fig. 6.)

To persons unfamiliar with such subjects, it is a striking fact that the buildings of our cities are constructed of the debris of the skeletons of marine animals, belonging to a bygone period of the earth's history, and that these same remains constitute sheets of limestone extending over many thousands of square miles, with a thickness of several hundred feet. As already stated, however, these

facts are very familiar to Geologists; yet they merit, especially with regard to the older formations, more attention in some res-

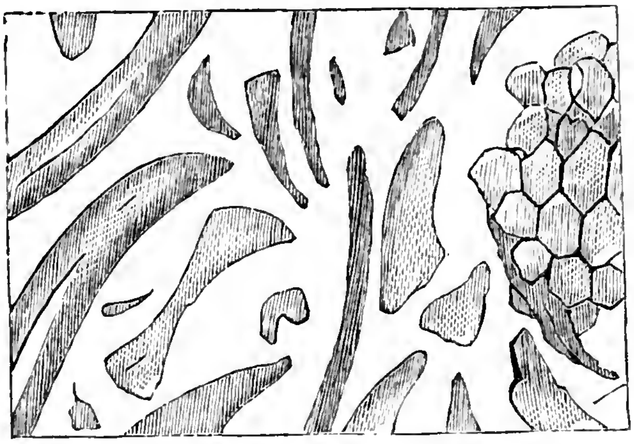

Fig. 6.—*Chazy Limestone, Island of Montreal,* (10 *diams.*)

pects than they have hitherto received. Microscopic examinations of organic limestones may serve to show the precise species which have most contributed to their accumulation, and the conditions under which their remains were spread abroad, and cemented into stone. They might also serve to identify limestones not containing entire organic remains, by showing the species out of whose fragments they had been formed. To do anything really valuable toward these objects, would require the patient preparation and examination of a great number of specimens; but, to any one who has leisure for the task, it might form a very interesting field of study.

ARTICLE XII.—*On Ozone.* By CHARLES SMALLWOOD, M.D., LL.D., Professor of Meteorology in the University of McGill College, Montreal.

(Presented to the Natural History Society.)

The investigations on the nature and properties of Ozone, have within the few past years engaged the attention, and become the subject of enquiry, alike of the chemist, the meteorologist and the physician. The chemist has found its manifestations and properties approximate to, if not identical with Oxygen in a peculiar state of existence or development. The meteorologist (especially of the European continent) has proclaimed it to be the instrument, or medium, that Providence has secured to provide for the production of the grand phenomena of nature; that its action can explain the formation of all meteors, as well as the fluctuation and diurnal changes in the pressure of the atmosphere indicated by the oscillations of the Barometer, and that it is the true cause and

means of restoring to animals and to man a sufficient and normal amount of Oxygen, to replace that which may have become consumed by animal respiration, and the various operations of nature and of art. The physician, in his investigations on the cause of disease, and as guardian of the public health, more es pecially in reference to diseases of an epidemic character, has not been silent in ascribing to it a salutary or deleterious agency in proportion to its presence or absence, and as exerting an important influence on the health of individuals and of nations, varying with the time, the season, and the temperature.

A substance, the knowledge of which seems to be fraught with life and health, both to the animal and vegetable kingdom, and which must, as a consequence, have an important bearing on the agricultural and commercial wealth of nations, demands from the man of science, a calm and patient investigation, so as to give to it a proper place in the annals of *true* science.

It is for this purpose that the present observations are submitted, trusting that in so vast a field for enquiry, many may be found as co-labourers—willing to contribute, however little, to the vast treasury of true knowledge.

As far back as the end of the 18th century Van Marum, in experimenting on the electrical action on oxygen speaks of the odour or smell being very strong, and which appeared to him as the smell of electrical matter, and it is scarcely to be doubted that Gilbert, Hawksbee, Dufay, Franklin and others were equally sensible of the peculiar odour generated by electrical action.

It is about 19 years ago since Schonbein, during his investigations on the decomposition of water by the Voltaic pile, remarked the odour that became manifest, and in a letter written to Arago in 1840, he says, "that for some years past he had been familiar "with the odour generated during the decomposition of water by "this voltaic current," and to this simple elementary body he gave the name of Ozone (from ozo, to smell).

The first accounts of the investigations of this substance may be found in the "*Memoirs de la Société d'Histoire naturelle de Bâle*," in the "*Journal de chimie pratique*," Erdmann in the "*Annales de Poggendorf*," also in the "*Archives de l'Electricité*" de Marignac et De La Rive, and also in the various *British scientific periodicals.*

Schonbein at this period of his investigations believed it to be a simple elementary body analogous to chlorine, bromine and

iodine, but his opinion soon became modified, and he declared that nitrogen was not a single body, but consisted of hydrogen and Ozone, and it was supposed really to be a component of nitrogen; and his opinion was supported by Assam, who showed the identity of *atmospheric Ozone*, and Ozone produced by chemical action or decomposition: further investigation led to the opinion that it was a peroxyde of hydrogen.

Schonbein soon abandoned the opinion that Ozone was a component of nitrogen, and inclined to the opinion that it was a peroxyde of Hydrogen. Marignac and De la Rive demonstrated that Ozone could be formed without the presence of nitrogen. And Berzelius had already expressed an opinion that it was oxygen in a peculiar state.

At this period of its history, Fremy and Becquerel undertook a series of experiments illustrating the action of electricals upon oxygen, and proposed the name of *l'oxygene Electrise* which seems to have been at that time also adopted by Schonbein. Its presence in the atmosphere and its special production, has placed it beyond doubt as a substance possessing peculiar chemical properties, although several methods have been adopted to produce it artificially, such as the action of sulphuric acid on bichromate of potash, and also on the peroxide of lead, the most simple and easy method is by the use of Phosphorus. The process generally adopted is by taking a stick of phosphorus, cleanly scraped, about half an inch long, and putting it into a large bottle which contains just sufficient water to half cover the phosphorus, and then slightly closing the mouth, and letting it stand for some time at a temperature not less than 60°F. Ozone soon begins to be formed as is shown by the rising of the whitish fumes from the phosphorus which at the same time begins itself to be luminous. In a few hours the quantity will be considerable, and the bottle is then to be emptied of its contents, washed out and closed for use or experiment. The necessary conditions are that the air should be at the ordinary atmospheric pressure and at the temperature of about 60° F; humid and cold air retards and will scarcely give rise to its formation, and if the atmosphere be subject to an increased pressure, Ozone is not formed except by an increase of temperature: the presence of certain gases also prevents its formation.

It is also obtained by the decomposition of water by galvanism, and it may be formed in pure and dry oxygen gas by passing through it the electric spark. It may be said also to be formed generally when chemical combination takes place in contact

with the atmosphere, and the consequent reaction or disengagement of oxygen.

It is probable that oxygen may be modified more readily by electric action than any other gas, and it has been shown by Bequerel, Faraday and others, that it may be rendered magnetic.

Ozone is colourless, possessing a peculiar odor, resembling chlorine, and when diluted, cannot be distinguished from the *electrical smell.* Its density, according to Andrew & Tate, is said to be four times that of oxygen. It is a most powerful oxydizing agent, converting most of the metals into peroxides, it is very slightly absorbed by water after long contact,—a very high temperature destroys its properties,—it possesses bleaching properties, hence its affinity to chlorine; it combines with chlorine, bromine, and iodine. It is rapidly absorbed by albumen, fibrine, blood, &c. It is a most powerful disinfectant, and when largely diffused in atmospheric air causes difficult respiration, acting powerfully on the mucous membrane, and in still larger quantities may become fatal.

During the past year, Schonbein has been actively engaged on the modifications of oxygen, and is of opinion that there are two kinds of (allotropic) modifications of active oxygen, standing to each other in the relation of positive and negative, and that there are a positive active and negative active oxygen—an ozone and an ant-ozone which in being brought together neutralize each other.

Clausius has endeavoured to account for the relation of volume existing between simple and compound gases, by the assumption that in simple gases several atoms are combined to form one molecule of oxygen, that for instance one molecule of oxygen consists of two atoms of oxygen, and is of opinion that under special circumstances it may happen that among the number of molecules in a given quantity of oxygen some may be decomposed into separate atoms. These would differ in their relations towards other substances, from those combined into molecules, and he considers these uncombined atoms are Ozone.

Fortunately its presence, both in the state produced artificially in the laboratory, and also in the atmosphere, is easily detected. Its rapid production, its peculiar smell and other properties, render it somewhat less difficult to investigate than many other substances. We purpose more especially to consider its nature and influence in reference to Meteorology and its influence on animals and plants.

(*To be continued.*)

ARTICLE XIII.—*On the Relative Value of Human Life in Different Parts of Canada.* By PHILIP P. CARPENTER, B.A.

(*For the Canadian Naturalist.*)

While the naturalists and geologists of the Royal Mount throw light on each other's studies in reference to extinct Palliobranchiates or recent Gasteropods, it may not be out of the province of this Journal to record facts in reference to living men and women; and those who would have been living had not the teachings of modern science been disregarded, or considered as of secondary importance to the pursuit of money or of power.

The exact connection between those sanitary conditions over which man has control, and the actual number of deaths in any town or district, is no longer a matter of hypothesis. The very accurate system of registration of births and deaths which has been carried out in England for more than 20 years, and of which classified returns are regularly published by the Registrar-general, has enabled chemists, physiologists, statisticians and other sanitary reformers to compare their theories with recorded facts, and to check off their reasonings, by the average of a long series of years. The following instance will shew the precision with which sanitary reformers can now predicate the rate of mortality according to the external circumstances of drainage, ventilation, &c. While Mr. P. H. Holland was registrar of the southern portion of Manchester (called Chorlton-upon-Medlock) he went through each district, tabulating each street, court, &c., in three columns, judging by his senses and knowledge what their rate of mortality was likely to be. In each street he also made a threefold division of the houses, according to their character. Here therefore were *nine* divisions, to each of which he assigned a *supposed* proportion of deaths to population. He then directed his clerk to tabulate the *actual* deaths in each of these divisions, taking the average of five years. On comparing the theory and the facts together, *in no case did they vary more than one-half per cent.* The following are the results, omitting the fractions:—

Deaths per 1,000 inhabitants in	Best houses	Middling houses.	Worst houses.
Best streets..........	19	22	27
Middling streets......	18	26	28
Worst streets.........	..	28	40

Thus the inhabitants of the best houses, in the best streets, live

more than twice as long as those in the worst houses of the worst streets.

The existing state of knowledge in England on these subjects, may be gained (1) from the quarterly and annual reports of the Registrar-general; (2) from the reports of Her Majesty's Commissioners on the Sanitary Condition of the working classes, and on the Health of Towns; (3) from local reports and tracts published by the various Health-of-Towns' Associations. The present laws of England will be found in the "Public Health Act," and especially in the "towns-improvement clauses." All these documents could be obtained, either gratuitously or at a very moderate expense, on application to "P. H. Holland, Esq., H. M. Commissioner for Burial Grounds, Burial Board, Whitehall, London, England." They would form a very important addition to the public libraries of every Canadian city.

It is not to be expected that in a newly settled country, where the population greatly fluctuates, according to the accidents of immigration or commercial prosperity, the same accuracy of detail can be arrived at. But, by collecting the facts already accessible, we can both take measures to guard against errors in future returns, and shew the necessity of immediate sanitary regulations.

For the year 1851, we are in possession of tables, very carefully drawn out, both of the population and of deaths, arranged according to different ages and conditions, in the various cities and districts of Upper and Lower Canada. By comparing these, one with another, and taking the average number of deaths for every thousand inhabitants during the year, we obtain the following results; the fractions here, as elsewhere, being disregarded.

For the purposes of comparison, statistics are added from England, where the returns are most accurately made, and the causes of error most carefully guarded against; and from the last official Registration Report of Massachusetts, as being a long settled State, in climatal conditions not very dissimilar to those of Canada. The general mortality of the principal part of Rhode Island is also added, from the Government Report.

Census of 1851.	Total population.	Total deaths.	Deaths per 1,000 inhabit's.	Percentage of total deaths. Under 5 years.	From Zymotic disease.
All Canada............	1,842,265	19,449	10½	43	25
Upper Canada.........	952,004	7,775	8	42	23
Do. less 5 large cities...	880,737	6,754	7½	41	23
Toronto...............	30,775	474	15	52	19
Hamilton..............	14,112	172	12	47	42
Kingston..............	11,585	185	16	56	8
Ottawa................	7,760	90	11½	48	29
London...............	7,035	100	14	49	24
Lower Canada.........	890,261	11,674	13	43	26
Do. less 2 large cities...	790,494	8,632	11	39	28
Montreal..............	57,715	1,978	34	43	15
Quebec...............	42,052	1,064	25	69	37
English Rural Dis.. 1841	3,440,501	66,575	19	..	..
Forty large towns. "	3,759,186	96,999	26	..	..
Liverpool parish. 1840–2	....	......	35	54	..
Bristol city....... "	....	......	26	42	..
" Rural Dis... "	....	......	19	33	..
" U. Clifton.. "	....	......	16	25	..
" L. Clifton.. "	....	......	34	51	..
Massachusetts 1853–1857	1,132,369	20,905	18	39	27
15 cities in do. above 10,000 inhabitants.	417,838	9,310	22	46	..
Whole State, less 15 cities.... "	714,531	11,595	16	34	..
Boston............ "	160,490	4,195	26	47	..
Charlstown....... "	21,700	505	23	48	..
Fall River........ "	12,680	382	30	54	..
Springfield....... "	13,788	265	12	47	..
Rhode Island State. 1853	118,722	1,126	9	..	28

Confining our attention at present to the third column, that of comparative mortality, we cannot but be surprised at the two following results: (1) the extreme healthiness of the country districts generally, and of the cities in Upper Canada; and (2) the extreme mortality of Montreal, notwithstanding the beauty of its streets and the substantial comfort of its mansions. It is natural to suppose that some peculiar disaster that year befel the city, from which the rest of the Province was exempt. Let us endeavour, therefore, to see how far the same ratio holds in other years.

In the Prothonotary's office are tabulated, year by year, the number of deaths and the increase of population by birth; Ottawa, Vaudreuil, Two Mountains, Terrebonne, Leinster, Berthier, Richelieu, St. Hyacinthe, Rouville, Verchères, Chambly, Huntingdon, Beauharnois, Missisquoi, Stanstead, and Shefford, containing a population of 428,588 souls, according to the census of 1851; partly rural, partly gathered into towns; subject to the same

climatal relations as Montreal, and inhabited by a people having the same religion and habits of life. The balance of wealth and the means of comfort are obviously in favour of the city. If Montreal has more than its share of sick persons, through the attraction of the hospitals, the same is true of Quebec and Toronto. Moreover, it is proverbial how long persons live in these establishments, owing to the kind and watchful nursing of the Sisters of Charity. And whatever increased mortality may be due to this cause, is probably more than counterbalanced by the number of consumptive patients who are sent out of the city into the country to die. The following are the returns, commencing with 1851, when first we have an accurate census of population. It will be remembered that 1852 was the year of the great fire, and 1854 of the cholera.

	MONTREAL CITY.				COUNTRY DISTRICTS.			
YEARS.	Total population.	Excess of births over deaths	Total deaths	Deaths per 1000	Total population.	Excess of births over deaths	Total deaths.	Deaths per 1000
1851	57715	+ 918	1978	34	428588	+11423	5853	14
1852	58633	+1053	1992	34	440011	+11093	6326	14
1853	59686	+ 763	2278	38	451104	+11280	6525	14
1854	60449	— 463	3739	62	462384	+ 8316	8731	19
1855	59986	+1028	2231	37	470700	+ 8586	7869	17
1856	61014	+1262	2284	37	479286	+ 9564	7184	15
1857	62276	+1438	2367	38	488850	+ 9447	7380	15
1858	63714	+1495	2299	36	498297	(+ 9447)*	(7521)*	15
Total	483473	+7494 or 16 per 1000	19168	40	3719220	+80156 or 22 per 1000	57389	15
do. less 1854	423024	+7957 or 19 per 1000	15429	36	3256836	71840 or 22 per 1000	48658	15

* The registration districts having been altered in 1858, these numbers are inserted hypothetically to complete the average.

It is not pretended that these tables are precisely correct. Absolute accuracy is of course unattainable in a country where there is no compulsory system of registration; the yearly returns of births and deaths being simply the records kept of religious ceremonies. In the country districts of Upper Canada, doubtless a large number of infants are born and corpses interred without any other record than in the family bible, if indeed in that. Still, each of the Upper Canadian cities, where deaths at least are recorded, shows so healthy a condition that the mortality of the country is probably not much greater than that recorded. But in Lower Canada, where the religious habits of the Catholic population almost compel resort to the font and to the cemetery, we may regard an average of 7 years as a fair criterion of its sanitary condition.

On examining the tables for the country districts, we find an extremely rapid rate of increase, being no less than 22 per thou-

sand each year. This speaks well, not only for the morality and industry of the inhabitants, but also for the resources of the country. The mortality, however, appears slightly on the increase, and presents an average considerably above the mortality of the whole province in 1851. This average is not essentially disturbed by the cholera year. It is probable that the extra mortality of the rural districts of Lower above Upper Canada, is due not so much to the severity of the climate (which in Ottawa city closely resembles that of a large part of the Montreal District) as to the close stoving and intensely dry and heated rooms; a habit which would doubtless carry off a much larger number of victims, were it not for the extreme purity of the surrounding atmosphere.

The point, however of most *vital* importance, for it affects the lives of thousands, and the health of myriads, is the *excessive mortality of Montreal.* Not only did it present in 1851 a ratio of death greater than that of any city in Canada or New England; amounting to 8 per 1,000 over Boston, with its immense and crowded Irish population; 9 per 1,000 over Quebec, with its bleak climate, narrow streets and rock-bound courts; 20 per 1,000 over the five cities of the West, and the same over the country district, six times as populous, in the midst of which it raises its beautiful domes and spires; not only so, but its *mortality has been increasing;* and on the average of 7 years, even leaving out the terrible 1854, it presents a catalogue of deaths greater than that of Liverpool (the most unhealthy and over-crowded of English cities), in its most unhealthy epoch, before the days of sanitary reform; when 39,460 of its inhabitants lived in 7,892 *cellars;* when 55,534 fought against death in 1,982 courts, containing 10,692 houses, built back to back, one third of them *closed at both ends*, and at best provided with only a surface drainage, which might be called a fever-bed condensed.*

* At that time the cellars were generally from 10 to 13 feet square, sometimes less than 6 feet high; often with only bare earth for a floor; frequently with no window, and the ceiling on a level with the street. Generally there was no other drainage than a cess-pool under a board, which had to be ladled out; sometimes a cess-pool of putrid matter was allowed to incubate its fevers under a sleeping bed. Sometimes a back cellar was used as a sleeping room, with no light or air but what could enter through the front. Each house above contained two or more families, among which one woman complained that they were "rather crowded, since the people in the next corner took lodgers." The population was huddled together to an extent *nearly three times the maximum*

But it is not fair to leave out the cholera year from the average. The same poisonous gases which yearly raise the mortality from 14 to 34 or even 38 per 1,000, occasionally concentrate their energies for the development of a cholera, a ship-fever or some other pestilence. Such visitations are often looked upon as "special providences;" but they are as natural and necessary results of culpable neglect in sanitary matters, as is delirium tremens of continued intoxication, or ship scurvy of unwholesome diet. The people of Montreal must continue to lodge such visitants so long as they make homes for them in putrid emanations; and they would be deprived of what is justly their own if these pestilences were excluded, as much as if the key were turned in their market of Bonsecours or in the parish church of Notre Dame. The fire did not add to the mortality of the city; it consumed the fever-beds as well as the dwellings, and drove the people into the shelter of the fresh air. But the cholera found a congenial atmosphere in the swamps of Griffintown; it not only devoured the yearly increase of the city, but killed off 463 persons *over and above* as many as were born that year; so that for *each thousand of the* 60,000 inhabitants of the city, sixty-two human beings perished. The grave that year hastily swallowed up 3,739 living souls. The worst recorded pestilence in England during the present generation was the Famine-Fever year of 1848, in Warrington. In that year one out of every 20 inhabitants died; in the Montreal Cholera of 1854, *out of every fifteen citizens one was found dead!* A widow said of the first visitation of the dreaded Asiatic pestilence in Bristol, that it was a "blessed cholera;" and she spoke truly, for it was the cause of the Sanitary Reform movement, which has saved its myriads of lives and will save its millions more. The fever in Warrington led to the immediate cleansing of its filth; and its inhabitants are now yearly taxing themselves large sums for investment in the underground life insurance. The people of Montreal have to this day retained their unenviable distinction as the dwellers in the city of wealth and death; and even last year their Council not only refused to lay the dust of the city, but could not draw water enough from the mighty river to allow the inhabitants to do it at their own expense!

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density of London, and consisted in great measure of the dirtiest and poorest of the Irish race. Such was Liverpool in 1841; and *more unhealthy even than this* has been Montreal from 1853 to the present time; although for five months in every year its laboratories of pestilence lie harmless in the safe prisons of the ice and snow!

Montreal was not the only city which was scourged by cholera. Vaudreuil and Lachine, in its immediate vicinity, shared the plague; but with how different results the following table will show.

Analysis of 3 years, 1853–1855.		Total population.	Excess of births over deaths.	Total deaths.	Deaths per 1000.
1853	Lachine..	20376	+355	349	17
	Montreal..	59686	+763	2278	38
	Vaudreuil.	22647	+609	394	17
1854	Lachine..	20731	+ 53	614	29
	Montreal..	60449	—463	3739	62
	Vaudreuil.	23256	+404	556	24
1855	Lachine..	20786	+328	402	19
	Montreal..	59986	+1028	2231	37
	Vaudreuil.	23660	+192	257	11
Total for 3 years.					
1853–1855	Lachine..	61893	+736 or 12 per 1000	1365	22
	Montreal..	180121	+1228 or 7 per 1000	8248	46
	Vaudreuil.	69563	+1205 or 17 per 1000	1107	16

Several causes may be assigned for the frightful amount of mortality which the stern facts of the burial registers assign to the city of Montreal. The first of these is emigration. The emigrants are said to be a peculiarly unhealthy race of people, landed on the shore only in time to die. If that were the cause, we ought to find the mortality of Quebec greater than Montreal, as the poorest and most sickly are unable to proceed further; whereas Quebec only loses 25 to 34 who perish at Montreal. Moreover, the earlier years, when the emigrants were most numerous, were far more healthy than the later ones, when emigration has considerably slackened, and when those who arrive are much better cared for. The principal way in which the emigrants affect the returns is by increasing the population. This will probably lessen the average of later years; to what extent the coming census only can decide. It is the custom in each city to state loosely the supposed number of its inhabitants; I have not been able, however, to find any accurate returns beyond those given above. The tide of emigration affected Toronto fully as much as Montreal; yet its mortality is *considerably less than half* that of its older sister. As an offset to the increase of population, it may be necessary to say, that, in each year but one, several of the religious bodies sent in no returns (on the average, 6 each year). It is presumed, however, that the number of deaths thus unregistered is but small.

Again, it will naturally be supposed that the free use of liquor in Montreal is a principal cause of its extreme mortality; the Catholic rural population being peculiarly sober in their habits. How great is the effect of drinking on health, the two following classes of facts will testify. The first is from an analysis of the books of eleven Sick Clubs in the town of Preston, Lancashire, of which 8 were open to all, and three were restricted to teetotalers. They are each corrected to a scale of 1,000 members.

Average of Preston Benefit Societies.	Number of members sick.	Average time of sickness.	Total weeks sick.	Cost to the Club.
Temperance clubs,	139	3 wks. 2 ds.	458	$1013
General clubs,	233	7 " 4 "	1770	$4012

The second is extracted from the "Journal de Société de la Morale Chretiènne" for Aug. 1847. The testimony is very accurately ascertained, and gives a comparison of *strong country labourers* where liquor was distributed, with *sickly inhabitants of towns* where the drink money was expended on better food. Both parties were employed on government work. In the country districts of Holstein, Mecklembourg, Oldenbourg, and Hanôvre, *where drink was given*, out of 20,952 labourers employed, 472 became sick, or one out of every 44. Whereas out of 7107 labourers from the towns of Brunswick, Oldenbourg, and the Hanseboroughs, *to whom drink was not supplied*, there were only 70 sick, or one out of every 90.

But the deaths in towns do not so much result directly from drinking, as is shown by comparing Montreal with Toronto and Ottawa, where drinking was just as much followed, and yet the mortality continued low. The usual effect of liquor is to weaken the constitution of its votaries, and thus render them an easy prey to the various forms of town disease, which abstainers are frequently able to avoid or at least to throw off.

The early exposure of infants by Catholic parents, for baptismal purposes, has also been assigned as a cause for the extreme mortality of Montreal. But this cause will affect, to an equal or even greater extent, the adjacent or rural districts; whereas, out of every 100 deaths in Montreal, 43 are of children under 5 years of age; in the country only 37: while in the Protestant cities of Upper Canada, the mortality is much greater, varying from 47 to 56. In England the fourth column of the original table furnishes a very exact guide to the amount of preventible mortality. In Canada there appear anomalies which would perhaps be explained

by an average of many years. Such is the enormous infantile mortality of Quebec, amounting to 69 out of every 100 in 1851.

The same may be said with respect to the last column, which represents the percentage of deaths arising from "xymotic" or *air-poison* diseases, which, though generated even in country places, are peculiarly destructive in towns, where they are not instantly diluted with fresh air. In England, out of every million persons living in the country, 3,422 die every year of these diseases; while of the same number living in towns, 6013, or *nearly double the number*, die from the same causes. The returns for Canada, however, will have to be corrected by an average of years; for we find healthy Hamilton losing half of its total number from these diseases, while Montreal loses only 15, and Kingston, with less than half its mortality, only 8. The town-smells, therefore, have other ways of killing-off those who inhale them than by infectious complaints, and this they do, in general, by the gradual weakening of the constitution, through which the system is unable to bear up against whatever disease happens to attack the sufferer.

It appears, therefore, by comparing the averages of Montreal and its adjacent districts, even leaving out the fever year, that there are 21 deaths in every thousand persons which might yearly be prevented; that is, on the present population of (say) 65,000 inhabitants, *the people of Montreal kill-off thirteen hundred and sixty-five of their own flesh and blood* every year, who would not die did they only pay as much attention to health in the city as they do in the country; to say nothing of hundreds of lives more which country and towns' people alike sacrifice on the altar of self-indulgence and "*laissez-faire.*"

But this is not all. From the returns of the Manchester Dispensaries, it appears that to every case of death there are 28 cases of sickness. These, on the average of the Preston Sick Clubs, last 5 weeks each. Therefore the people of Montreal voluntarily tax their health to the extent of 38,220 cases of sickness *every year*, which is equal to a loss of 191,100 weeks, or 2,674 years; that amount requiring to be taken twice over, once for the suffering invalid and again for the anxious nurse.

Nor is this the whole of the evil. There is a large amount of general enfeeblement of health, which does not develope into actual disease. This brings misery on the daily life, urges to the use of poisonous stimulants, often leads to recklessness of conduct, destroys the desire and even the power of amendment, and works corruption throughout the whole fabric of society.

To the work of palliating or curing diseases, 25 physicians or other medical men honourably devote their lives, and are thankfully supported by the inhabitants, along with 15 vendors of drugs; in all, an apparatus of 40 persons devoting their energies to restoration, besides large numbers of Hospital attendants, Sisters of Charity, and other nurses employed in tending the sick. But to this day the city of Montreal does not employ a single officer of health to detect the *causes* of preventable disease, nor does she make it a requirement in the men she elects to her Municipal Council, that they should enforce those sanitary regulations which the law empowers them to carry out.

The limits and scope of this paper do not allow me to point out the special causes of this extreme mortality, nor the means required for their removal. It may be sufficient to place on record an account of a court in the Petite Rue St. Antoine, which I visited in April last in company with a Domestic Missionary. It was by no means so bad as many parts of the Griffintown suburbs. It is to be hoped that the time will soon come when this description will be as great an antiquarian curiosity as the "plague-stone" in the Warrington Museum, in a hollow of which the money was passed through vinegar to prevent transmission of infection.

We left the street through a covered passage, treading on bricks and pieces of wood through a mass of wet and decomposing manure and filth. Reaching thus the small back-yard, we found it to consist apparently of a widely-extended midden, consisting of disgusting slutch and every kind of refuse, from a few inches to some feet in thickness. On two sides, this yard was separated from two similar ones by partition fences; on the other two it was enclosed by dwellings. The inner house, or rather hovel, was divided into two; the two little rooms upstairs, inhabited by a French family at a rent of $4 a month; those below by two families, paying $3.50 for the liberty of being poisoned. The miserable rooms not only got no air but what was charged with the stenches of the yard, but just outside were several privies, too disgustingly filthy to be used, but breeding "nast" to soak through the wooden walls and floor of the inner room. This was filled by a family, where of course there was sickness; with closed door and window, so that no air entered but what was saturated with fever-stenches. For the upper rooms of the cottage opposite, $8 a month were paid. On descending the stairs to reach the street, we had to cro s over fluid matter, stepping on bricks. The lower story, for which $6

are generally paid, was now necessarily empty, being flooded, I will not say with water, but with liquid manure, the disgusting emanations from which ascend through the stair case and between the boards, into the upper story. It was by wading on bricks through this mass of pollution that the tenant had to obtain her supply of water; this being the one only health-spot in the whole, where the pipe, rising through the fœtid drainage of the court, discharges the pure water of the Ottawa for the pallid occupants. The upper tenants had been there for 15 months, and assured me that the yard had never been cleaned during the whole time. And yet the authorities, who confiscate unwholesome meat when offered in the shambles, allow the use of these unwholesome dens to be freely sold to those whose ignorance or poverty keeps them from remonstrance; and men are found willing to draw $21.50 a month, as payment for the privilege of inhaling poison, in places where no right-thinking man would keep his horse, scarcely his pig; and where he would not live himself (or rather die) for any amount of money.

During the long months of winter, all injurious emanations are happily frozen up, like the fabled tunes blown into Munchausen's horn. But when the spring thaw comes, the whole mass of corruption, which has been accumulating on the surface and among the snow, is set free; not only sinking into the unpaved back yards, and there laying by a deep store of pollution to rise up at the bidding of the summer sun, in the form of fever or cholera; but running into and around the dwellings, soaking into the floors, and sponged up by the timber walls, where the reeking colour, premonitory of disease, is hidden behind some tawdry paper; and the heedless victim of ignorance, generally also of intemperance, hires the poisoned coffin in which his wife and little ones are constrained to dwell.

In the more healthy parts of the city, the winter manure is dislodged by the melting snow and precipitated on the solid matter. As the streets rapidly dry, fine dust is formed in immense masses; and while the poor below are wading on bricks through the liquid stench-bowls,* the gentry are inhaling similar pollutions in the form of impalpable and perceptible dust. It is evident that both

* The myriads of flies of which the inhabitants complain, are the necessary result of the putrid refuse. In the present state of the city, they act as nature's scavangers, and should be reckoned among the greatest blessings.

streets and yards should be cleared as soon as ever the substance is soft enough to be removed; that the liquid manure, instead of running to waste in the river, should be employed to fertilize the land; that all back yards not used for cultivation, should be paved with brick or stone; that houses should be drained with some other material than wooden troughs; that the plan of fixing frame houses on wooden legs over swamps should be expressly prevented; and that a complete system of sewerage should be provided for the poorer, far more than even for the wealthier portions of the community.

The mere fact of sewering and cleansing 20 streets in Manchester, inhabited by 3,500 persons, reduced the mortality from 31 to 25 per 1,000; that is, prevented 21 deaths and 588 cases of sickness in 7 months. In Windmill Court, London, there were 41 cases of sickness in 7 months. The landlord paved and sewered it, and supplied it with water; and in the same space of time afterwards, there were only 2 cases. He did it at his own expense, and "made a good thing of it."—When the Manchester Council swept their streets by machine every day, they found that the roads scarcely ever needed repair. In Aberdeen and Perth, the expense of the similar daily cleansing was more than covered by the sale of the manure.

What is poison to man is food to the plant. One pound of urine contains all the elements necessary for one pound of wheat. The fœcal matter of two adults is sufficient manure to raise an acre of corn or pease; or that of one man will produce an acre of turnips, if the green matter is returned to the soil. The value of manure in Flanders is $9·25 per man. Land near Edinburgh, which used to let for only $15 per acre, now fetches from $100 to $200 per annum, simply from being irrigated with town refuse. And in the town of Rugby, the system of drainage is so complete that whatever is deposited in the dwelling in the morning, by noon is spread over the fields in a minute state of division, before decomposition has time to develope its poisonous stench.

As the cost of sanitary measures is generally the greatest obstacle to their adoption, it may be well to inquire whether their neglect is not still more costly. The following is an attempt to exhibit the—

ANNUAL PECUNIARY LOSS TO THE CITY OF MONTREAL, RESULTING FROM "LAISSEZ FAIRE."

Value of manure, now run to waste or breeding sickness, on 65,000 inhabitants, besides animals, say at $3,..........	$195,000
Loss from 191,100 weeks of preventible sickness, at $3 per week,.	573,300
Cost of 1,365 funerals at $15 each,......................	20,475
Supposed pecuniary value of 1,365 lives; estimating a Free Canadian simply as property, at Elihu Burritt's tariff of $300 per head,..................................	409,500
Maintenance of orphans, &c., say.........................	1,725
Total,..................	$1,200,000

To which ought to be added an indefinite amount for injury to stocks of goods, dress, furniture, &c., resulting from dirt and dust.

These and similar facts prove that, however expensive sanitary reform may be, the present system is far more so; and that however difficult it may be to cleanse the Augean stables in the back yards of Montreal, it is the duty of the Council to see that the wages of death are no longer wrung from the hard earnings of the poor, but that all who undertake to let houses shall be compelled to put them and their surroundings into a condition favourable to health and life.

If a Statistical Society were formed to collect and verify information on this and other social subjects, it might be able to lay important facts before the governing bodies; and might point out the causes of error in the present returns, with a view to their correction in the forthcoming census. The English "Health of Towns Associations" have also been extremely useful, (1) in making reports of the actual condition of their respective localities, by visiting from house to house; (2) in diffusing information among the masses of the people by free lectures and plainly written tracts; and (3) in watching and acting upon city officials and owners of property, in a way which private individuals hesitate to do.

When Edwin Chadwick, Esq., the first mover of sanitary reform in England, visited the Exhibition of Industry in Paris, every opportunity was offered to the deputation from the Society of Arts, of which he was a member, to see the notabilia of that magnificent capital. The Emperor afterwards asked him what were his impressions of the city. He replied by giving Louis Napoleon a half-hour's disquisition on the sanitary condition of Paris, and the necessary steps to be taken for its immediate improvement. The courtiers were filled with indignation; His Majesty answered by

a smile.—In the same way I have endeavoured to show my grateful appreciation of the kindness of the Canadian people, by applying the knowledge gained in the old country to the altered conditions of the new, and shall be rejoiced indeed if what has been written, strongly, it may be, but calmly and advisedly, should be received, neither with indignation nor with smiles, but with a determination to amend the laws of disease and death, by which the inhabitants of Montreal have thus far been governed. Let the Queen City of the North, that sits enthroned on the Royal Mount, with for her footstool the River of Freedom, her breast adorned with princely mansions, her jewels of colleges and cathedrals her boast of commerce and of wealth, be clothed with the white robe of Health, pure as her winter's snows, and crowned with the diadem of Life, bright as her summer's sun, so that her future may fulfil the prediction of the Prophet,—

"My people shall not labour in vain,
"Nor bring forth children for early death.
"No longer shall there be an infant of days,
"Nor an old man that hath not fulfilled his time:
"For he that dieth at a hundred years shall die a youth,
"And the sinner dying at a hundred years shall be held accursed.
"They shall not build, and another inhabit;
"They shall not plant, and another eat:
"For as the days of a tree shall be the days of my people;
"Yea, long shall they enjoy the works of their hands."

Is. lxv. 20–23.

Boston, May 13, 1859.

ARTICLE XIV.—*On a specimen of Aboriginal Pottery in the Museum of the Natural History Society of Montreal.*

(Read before the Natural History Society.)

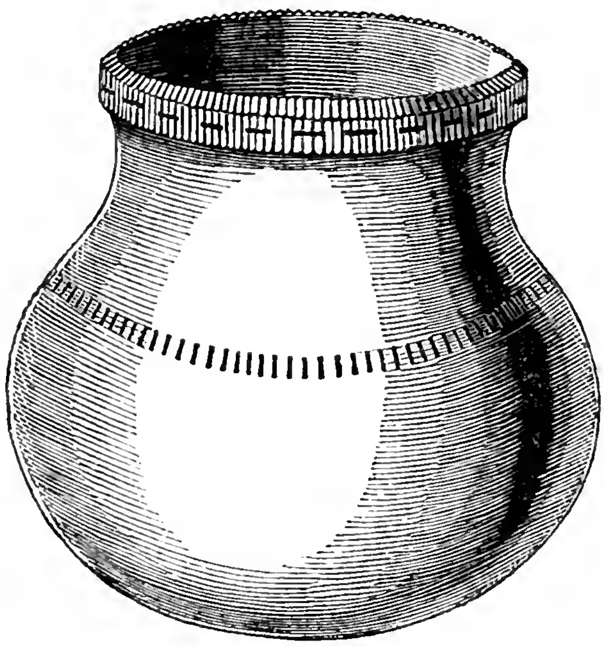
Among other treasures of this Society recently exposed to view by the re-arrangement of the collection in the new building of the Society, is a remarkably perfect earthen vessel of Indian workmanship, presented by Mr. H. T. Goslin of Clarendon, Pontiac county, through the Lord Bishop of Montreal; and which, but for the confusion incident to the removal of the Museum, would have been noticed in this journal some time since. It was found, along with another of similar form and dimensions, under a flat stone, in a rudely walled space prepared for the vessels, which were placed mouth to mouth, and contained only a

small quantity of brownish powder. No other aboriginal remains were found with them, nor anything to indicate the probable purpose of their interment. The precise circumstances in which they were found were thus communicated by Mr. Goslin to the Society.

"The urn was found on lot No. 4 in the 8th range of lots in this township (Clarendon). A number of years since, when Mr. Seaman, the owner of the farm, was clearing the land, his attention was attracted by a singular wall or mound of stone. He saw a part of the urns (which were placed vertically), and at first supposed it was a stone carved in that form, and paid no further attention to it till July, 1856, when he went to it, and removing a part of the wall, found the urns. They were placed vertically, the mouths being joined, and the lower one filled with earthy matter, a part of which is sent with the urn. Having heard of the affair, I visited the spot, and hoping to make further discoveries, obtained help, and with levers removed the large stone which was over the urns. We found beneath it a wall regularly laid, though not cemented, enclosing a space 8 feet by 6. The wall was about 5 feet high; 3 feet below and 2 feet above the surface, and open at a part of the west side. As the stone which covered it had been broken by some means, probably by the action of fire, I could not ascertain its exact dimensions. That part which I measured was of an irregular figure, about 6 feet 8 in. in length, 4 or 4½ feet in breadth, and from 1½ to 3 feet in thickness. Evidence of the antiquity of the structure is afforded by the fact that since it was built a maple tree had grown to the size of about 20 inches in diameter, decayed, and fallen; its roots, together with those of several smaller trees and shrubs, having extended over the wall. The soil on that part of the wall at the west side was about 10 inches deep."

The form of the urn is represented in the accompanying wood cut. The material is a fine reddish felspathic clay with many grains of quartz and films of mica; the whole being apparently the product of the decomposition of granite, and, independently of the coarse particles intermixed, an excellent material for terra cotta. The form is as regular as if moulded by the potter's wheel, and is not deficient in symmetry. The general surface is smooth, with very fine revolving lines, produced by the instrument used to give form and finish to the exterior. The thickness at the mouth is $\frac{3}{10}$ths of an inch: the circum-

ference of the mouth outside 24 inches, that of the narrowest part of the neck 23 inches, that of the widest part of the swell



35 inches. The depth within is 11 inches, or very nearly equal to the greatest transvere diameter. The edge or lip of the mouth is slightly bevelled outward and neatly marked with radiating sharp furrows. A band or fillet similarly marked, and $\frac{3}{4}$ of an inch in depth surrounds the mouth, and its sameness is agreeably broken by an interrupted horizontal furrow running round the middle of the fillet. A less distinct row of vertical furrows runs round the upper part of the swell. All these ornamental markings are very carefully and cleanly cut, and the whole aspect of the vessel bespeaks taste and skill in the workman, and indeed, compares favourably in these respects with some Roman cinerary urns, that stand on the same shelf, or with the ordinary pottery of our own time.

The brown powder found in the vessel, appears to be the remains of some coarse farinaceous substance, probably Indian meal, or pounded parched corn.

In its form and ornament this vessel is of the same type with the Indian pottery of all parts of North America; as for example with that found on the sites of Indian villages in the state of New York, and in the western mounds, and still in use among the Mandans and other nations of the west. Anterior to European colonization, the Indian tribes appear pretty generally to have made coarse pottery, without the aid of the potter's wheel, but the art disappeared rapidly from most of the tribes, on the introduction of metallic vessels. "Upon the site of every Indian town," says Squier,* "as also within every ancient enclosure,

* Aboriginal Monuments of New York (Smithsonian Contributions).

fragments of pottery occur in great abundance. It is rarely, however, that any entire vessels are recovered. Those which have been found, are for the most part gourd-shaped, with round bottoms and having little protuberances near the rim, or often a deep groove by which they could be suspended. A few cases have been known in which this form was modified and the bottoms made sufficiently flat to retain the vessel in an upright position, fragments found in Jefferson County, seem to indicate that occasionally the vessels were moulded in forms nearly square, but with rounded angles.* The usual size was from one to four quarts; but some must have contained not less than twelve to fourteen quarts. In general there was no attempt at ornament; but sometimes the exterior of the pots and vases were elaborately if not tastefully ornamented with dots and lines, which seem to have been formed in a very rude manner with a pointed stick or sharpened bone. Bones which appear to have been adapted for this purpose are often found. After the commencement of European intercourse, kettles and vessels of iron, copper, brass, and tin, quickly superseded the productions of the primitive potter, whose art at once fell into disuse." These vessels were not only used for culinary and domestic purposes, but were sometimes buried with the dead, containing probably articles of food for their use in the spirit world; and, as Charlevoix mentions offerings of *sagamatie* or pounded parched corn to the dead, this may have been the substance contained in the Clarendon vases, which may have been buried, either as an offering of this kind, or as a store of provision for the living. It may appear adverse to the former supposition, that vessels placed with the dead were usually rendered unserviceable, a fact observed in Canada and Oregon, and of which the writer once met with an instance in Nova Scotia. In other instances, however, uninjured vessels are known to have been deposited in this way. †

The modern manufacture of pottery among the Mandans is thus described by Catlin. "I spoke also of the earthen dishes or bowls in which these viands were served out; they are a familiar part of the culinary furniture of every Mandan lodge, and are manufactured by the women of this tribe in great quantities, and

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* There is a vase with a square mouth, in the collection of the Natural History Society.

† Lapham, Antiquities of Wisconsin (Smithsonian Contributions), p. 29.

modelled into a thousand forms and tastes. They are made by the hands of the women from a tough black clay, and baked in kilns which are made for the purpose, and are nearly equal in hardness to our own manufacture of pottery; though they have not yet got the art of glazing, which would be to them a most valuable secret. They make them so strong and serviceable, however, that they hang them over the fire as we do our own pots, and boil their meat in them with perfect success. I have seen some few specimens of such manufacture, which have been dug up in Indian mounds and tombs in the northern and middle states, placed in our eastern museums, and looked upon as a great wonder; when here this novelty is at once done away with, and the whole mystery, where women can be seen handling and using them by hundreds, and they can be seen every day in the summer also, moulding them into many fanciful forms, and passing them through the kiln where they are hardened." * Catlin does not mention the shape of these vessels; but they appear incidentally in several of his plates, and would seem to be often of the form of that referred to in these notes, though sometimes in that of flat bowls.

The interesting points in connection with this and other examples of Indian pottery, are, the general prevalence of the art even among the rudest tribes, its rapid disappearance on the introduction by commerce of better vessels, the similarity in form of these vases to those of most ancient nations and to the general forms of modern pottery, the accuracy of contour bestowed on them without the potter's wheel, and the selection of a material which has in all countries approved itself as the best suited for the purposes of the potter. These points are, I think, of sufficient ethnological interest to entitle this donation to a short notice in the proceedings of the Society.

J. W. D.

ARTICLE XV.—*On the Indian Tribes of McKenzie River District and the Arctic Coast;* from a Correspondent.

(Presented to the Natural History Society.)

This sketch of the language and manners of Chipewyan tribes, may be divided into three heads: 1st. the Geographical Distribution; 2nd. the various Branches of which the tribes are composed; and 3rd. an account of other tribes of different origin to be found in the McKenzie River District.

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* American Indians, vol. 1, p. 116, and plate 46.

The Chipewyans may be considered the purest stock, and call themselves Tonish or Dimish, (the People.) They are scattered over a large and important portion of North America, either themselves or their off-shoots. They are to be found in greater or lesser numbers from about 95° west longitude, to the Rocky Mountains, and from about 55° of lat. to the Arctic circle. By this statement I do not mean to say that they inhabit so extensive a tract of country, but merely that they are to be met with between these extremes. The most eastern of the H.B. posts to which they resort for purposes of trade is Churchill on Hudson's Bay, which they reach by descending the English River. I do not suppose they winter any where in the vicinity of the Great coast line, nor that they have much intercourse with the Esquimaux, what intercourse does exist however, is of a friendly character. On the south they are not met with below Isle-à-la-Crosse. About Lesser Slave Lake, and at St. Johns on the Upper waters of Peace River, Crees are the present inhabitants. The Lesser Slave Lake country, from its source evidently belonged at some former period to the Chipewyans, as the usual name given to numbers of this tribe is slaves, but they not being by any means so warlike as their opponents, have been in all probability beaten back by the superior arms and energy of the Cree nation. I have heard that one of the plain tribes the Cirsees was a Chipewyan off-shoot, and resemblance of language and general reports render this very propable. To the westward, the Chipewyan is found along Peace River, in the Beaver tribe, at Fort au Levid in the Slave tribe, and along the McKenzie in Slave and Stare tribes as far north as the Arctic circle, and the Bloody Fall on the Coppermine River.

The Chipewyan nation is bounded by the Crees to the southward, this latter people have penetrated though in small numbers to Athabasca Lake, and hunt in common with the Chipewyans the country along the Athabasca and English Rivers, and that lying between Peace River and Lesser Slave Lake. Although enemies formerly, they are now on intimate and friendly terms. To the eastward the intercourse of the Chipewyan with the Esquimaux is but trifling. A wide and barren tract of country intervenes between their hunting grounds and the coast, while the best means of water communication, the Great Fish River, is very dangerous. The Stare Indians indeed meet with the Esquimaux in an amicable manner on the Anderson river, a stream lately dis-

covered and surveyed by Mr. Roderick Ross McFarlane, lying to the eastward of Fort George Hope, and flowing into Liverpool Bay. To the northward and westward they fall in with the Loucheux, or Kutching, and are on the best understanding with them, although these people speak an entirely different tongue, are distinguishable in features, and distinct in their superstitions and habits of life. On the western side an intermixture takes place with the Nahannies, Siccanees, Manocies, Monde and other tribes of different names, but most likely all of cognate race with the Chipewyans themselves.

The known branches into which the Chipewyan race has divided itself are as follows: 1st. the Chipewyans of English River, Athabasca and Great Slave Lake; 2nd. the Beaver Indians of Peace River; 3rd. the Caribou Eaters and Yellow Knives of Athabasca and Great Slave Lake; 4th. the Dog Ribs of Great Slave Lake and Martin Lake; 5th. the Slaves of Great Slave Lake and the McKenzie and Levid Rivers; 6th. the Hare Indians of McKenzie River and Bear's Lake, all of which will be passed separately and briefly in review.

1st. The Chipewyans inhabit the south east portion of the territory already mentioned, and are the most numerous family of their race. The name Chipewyan or Chipawyan is apparently one given by the Crees, meaning (Chipaw), pointed and (wyan) shirts. If this be actually its derivation, it would appear that the Chipewyan tribes wore shirts or tunics of the same shape as the Loucheux dress at some former period. This shape is now never seen among them. The name among themselves is the rather grandiloquent one of Dimish, or The People. They are in general of middle-size and well proportioned, the face flat with high cheek bones, giving a pear-like appearance to the head. Their hair is strong and coarse, but they have neither beard nor whiskers; the hands and feet are small and well made. For an aboriginal people their character is not bad, for although selfish and grasping to the utmost degree, they are honest and far from blood-thirsty. They are all confirmed liars, and they treat their women more as slaves than companions. Morality among them is at a low ebb. Polygamy though not common exists, and, although very jealous of their wives, chastity in unmarried females is scarcely considered a virtue among them. A Roman Catholic Mission has been for several years established among this tribe, which doubtless has had some effect, in preserving the outward decencies of mo-

rality among its converts. Their Christianity is very impure, as they have mixed up many of their superstitions with the ceremonies of that Church. Fancy their sending letters to God, when any one dies, using the coffin as the post office !

2nd. The Beaver Indians, whose dialect is farther removed from the Chipewyans than that of any of the other branches, reside in the country along both sides of Peace River, as far as the upper waters of Hay River on one hand, and Lesser Slave Lake on the other, from just below Fort Vermilion to the Rocky Mountains. They are a bolder and braver race than the others, honest and hospitable, indeed superior in most points to the Chipewyans, whom they much resemble in features, customs, and moral character, as well as in the treatment of the softer sex. They live as Nomades, possess houses, and subsist principally on the products of the chase. They are good workers in iron, and fabricate very neatly formed spears and crooked knives from worn out files.

3rd. To the northward and eastward of the Fond du Lac of Athabasca, as far as to the north end of Great Slave Lake, Lake Aylmer, and the east side of *Yellow Knife* (Copper Mine) River, dwell the Caribou Eaters or Yellow Knives, who are the same tribe under two designations. They are a large and stout race of men, fairer and better featured than the Chipewyans, especially the women, who are much prettier. This may arise from the superior quantity and quality of their nutriment. Their language is almost pure Chipewyan ; they bear the worst character of any of the cognate race. Their notions of morality, honesty and veracity are very lax. Their location is in the low woods bordering on the barren grounds, at which latter they meet every summer for the Reindeer hunt, this animal being their great support. On its flesh they subsist, its skin affords them clothing, its sinews thread, and the raw hide when cut up into small lines like cat-gut, is used by them sometimes as a substitute for twine in the formation of nets. Though formerly at war with the Esquimaux residing at the outlet of Back's River, there is now no hostile intercourse between them, and the Yellow Knives seldom proceed further coastwise than the Head waters of the before mentioned river.

4th. Adjoining the Yellow Knives are the Dog Ribs, (Kloy Dimish), whose lands extend from Yellow Knife River to the southeast side of the Bear Lake, and to about midway between Martin Lake and the McKenzie River. In the latter part they

are much intermingled with the Slaves, from whom they can scarcely be distinguished, except by being of large stature, and possessing a thick stuttering and disagreeable manner of enunciation. They are comparatively very numerous, living principally like the Yellow Knives upon the Reindeer which abound in their country, and like that tribe clad much in skin dresses. Like all the Slave tribes in contradistinction to the Beaver Indians, Chipewyans, and Yellow Knives forming the Chipewyan division, these people are kind in their treatment of their women and dogs, and have the custom universal in all their race of dropping their original name upon the birth of a child. They are then only styled the father of so and so. But the Kloy Dimish go farther still, they change their name after the birth of *every* child, and an unmarried man is called the father of his favorite dog if he have one.

5th. The Slave Indians inhabit the tract between the west end of Great Slave Lake to below Fort Norman, extending up the Liards on one side and to Bear Lake on the other. At Fort aux Liards there is in this tribe a great mixture of Beaver race, to the westward of the McKenzie of the Siccanee and Nohanney. They are a well disposed and peaceable race, their life is a hard one; they subsist on hares, fish and deer, and often have great difficulty in obtaining the means of living. Notwithstanding this, a Slave would sooner starve than eat a piece of a dog or mink, indeed he will not skin the latter animal when captured in his traps, although its pelt is a valuable article of barter. They manufacture twine for nets out of the bark of a species of Willow, and dishes that hold water out of its plaited roots, more durable than from Birch bark.

6th. The Hare Indians reside in the country around Fort Good Hope on the McKenzie to beyond the arctic circle where they come in contact with the Loucheux, Quarrelers, or Kootchin, with whom by intermarriage they have formed the tribe of Loucheux Bâtards. They are a stout thickset race, subsisting partly on fish partly on Reindeer. There is little difference in the language from that of the Slaves, and their dress and customs are the same. With the Esquimaux of the newly discoverd Anderson River, they are on good terms. This tribe is not numerous, having perished in large numbers from starvation in 1841, when many sad scenes occurred. From long intercourse with the whites, for whom they have great respect and affection, most of the superstitions and customs of these tribes are extinct. Their idea either of the formation of the world or the deluge is that a muskrat dived

to the bottom of what was then all water, and brought up some earth which was moulded into consistency by the Beaver. The Loucheux entertain the same tradition in a slightly modified form. Chipewyans have ideas of a good and evil principle, but their adoration if it may be so called is paid to the latter, and consists of rude gesticulations, singing, and conjurations for the benefit of the sick, and called Nitch or Medicine. Their places of interment are rude cages or câches of logs placed on the surface of the ground, in which the body is deposited, wrapped in a blanket or moose skin, while the relatives destroy their property and cut their hair in sign of mourning. Their songs are unmusical and generally accompanied by drumming on a kind of tambourine, forming the usual Orchestra for their dances. The latter consist of ungainly leapings in a circle, commonly around the small fire used to light their pipes, and in them women are permitted to join. Moose-nose and hearts of animals, as well as the heads, are not allowed to be eaten by women or dogs, from a superstition that if such occurred the hunters would lose their skill. Among the Slaves of the valley of McKenzie, rabbits are the principal food. When these fail suddenly as they generally do, the natives fancy that they mount by the trees into heaven, and when they reappear, that they return by the same path. The moral character as well as the worldly condition of these tribes has been much improved by the mild and impartial sway of the Hudson's Bay Company. Polygamy as well as incest, is now of very rare occurrence. Intestine wars and murders are unknown, while infanticide, formerly so prevalent, has become almost a tradition. One point of their customs which I have overlooked, may here be mentioned. Their manner of personal combat is to catch each other by their long hair, and twist about until one falls down. Although this is in general a most harmless way of settling a dispute, instances have occurred of dislocation of the neck in the affray. Quarrels arise commonly about women, and the fair one becomes the prize of the conqueror.

A Protestant Mission of the church of England pursuasion is about to be established by the Church Missionary Society at Fort Simpson on the McKenzie River, for the Slave communities, which will doubtless improve in a high degree the religious notions and moral character of this interesting and inoffensive people.

The other tribes inhabiting the McKenzie River district are 1st the Siccanees; 2nd. the Nahannies or Mountain Indians; 3rd. the Loucheux or Kutchin; 4th. the Esquimaux.

1st. The Siccanees are a tolerably numerous tribe. In this district they resort to Forts Liards and Selkirk for purposes of trade and inhabit the country between the Liards and the head waters of Peace River among the Rocky Mountains entering into New Caledonia. If they speak Chipewyan, their dialect is a very corrupt one. In disposition they resemble the Beaver Indians, and they are generally of good stature.

2nd. The Nahannies live to the northward of the Siccanees, about the head waters of the Liards Rivers, Francis Lake and the Pelly River and westward across the mountains to the Pacific In appearance they resemble the Slaves.

3rd. The Loucheux are an exceedingly numerous and powerful people, if the various tribes of them inhabiting Russian America be taken into consideration. They occupy the northern waters of the McKenzie from below Fort Good Hope and Point Separation, where they meet the Esquimaux, as well as Peels River. They are found across the Rocky Mountains on the Rat River, on the Youcan or Kutchpark, and on the lower Pelly, in fact they people the greater part of the interior of Russian America.

In appearance they are bolder featured than the Slaves, as well as of larger stature. Their disposition is blood-thirsty, and independant, resembling a good deal that of the plain tribes. In the treatment of women they are harsh, and *female* infanticide is is not uncommon among them. Polygamy is prevalent as well as divorce for trifling misunderstandings. The Peels River Loucheux put their dead on scaffolds, those of the westward burn them, and much property is destroyed upon the death of a chief. A strong belief in the powers of Medicine men is universal among the Youcan tribes, no Indian dies by natural death, but he is killed by the conjuration of another at some distance, and this superstition is the cause of much bloodshed among them. The Peels River branch is at war with the Esquimaux. They were formerly a very numerous people, but war and disease have sadly reduced them. Several treaties have been patched up between these hostile nations by the Hudson's Bay Company, but only to be broken, and the avenging of fresh murders keeps up an unbroken line of deadly fueds. Having had a trading intercourse for several years with the Company's Post at Peels River, these people have become milder and much more tractable than their unsophisticated brethren on the Youcan.

The dress of the Loucheux or Kutchins is a peculiar one, it

consists of a tunic or shirt of leather coming to a point in the skirt both behind and before, ornamented with quills, fringes and beads. The trousers and shoes are of one piece, and are also garnished. Men and women are clad in like fashion in trousers.

4th. The Esquimaux as far as we know of them are very numerous. At the points with which we are acquainted, their coast line extends inland to below Point Separation on the McKenzie, the Bloody Fall on the Copper-mine River, and the confluence of the Great fish with the McInlay Rivers. They are a more powerful, braver and energetic race than the Indians. Their complexion in truth is fair, and some of their women are reported as absolutely beautiful.

ARTICLE VI.—*On the Natural History of the Gulf of St. Lawrence, and the distribution of the Mollusca of Eastern Canada.* By ROBERT BELL, jr.

Having been employed by Sir W. E. Logan to assist Mr. Richardson in his geological explorations in the Gulf of St. Lawrence during the summer of 1858, and at the same time to collect as many specimens as possible, to illustrate the natural history of that part of the Province,* the following lists, prepared by his directions, contain a brief summary of my observations, together with numerous facts regarding the distribution of the Mollusca in other parts of the country.

The district explored is that part of the Province below Quebec which is bounded on the north-west by the St. Lawrence, east by the Gulf, and south-east by the Bay of Chaleurs and Ristigouche River, and is chiefly comprised in the counties of Rimouski, Gaspé, and Bonaventure. By referring to a map of the Province the localities mentioned in this article will be readily found, the greater number of them being situated on the south-east side of the St. Lawrence, between Quebec and Gaspé. In these lists I give the names of all the localities at which each species was found when not generally diffused, from which some inferences may be drawn in regard to their geographical distribution; and I must here acknowledge my indebtedness to Mr. D'Urban of the

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* During the summer of 1857, I accompanied the same party on an expedition to the Gulf, and some observations which I then made on the natural history of the country through which we passed are published in the Report of Progress for that year.

Geological Survey, who most kindly furnished me with a list of the Birds, and drew up the accompanying Catalogues of Coleoptera, Lepidoptera, and Plants.

VERTEBRATA.

MAMMALIA.

Vespertilio subulatus (Say's Bat).—Numerous in the vallies of the Ristigouche and Matapedia Rivers. I killed one of them with my fishing rod, which in its eagerness to take the bait from my hook, did not cease to fly after it, till it met with its death.

Sorex Forsteri (Forster's Shrew Mouse).—Procured two specimens; said by the Indians to be very abundant.

Ursus Americanus (The Black Bear).—Not uncommon; there are two varieties in the district, one all black, and the other, which is said to be more ferocious, black with a white spot on the breast. The fur of the Gaspé bears is of a highly superior quality.

Mustela martes (The Pine Martin).—The Indians bring home from their winter hunts, more of the skins of these animals than of any other.

M. vison (The Mink).—Ranks next to the marten in its importance to the Indian hunter.

M. vulgaris (The Common Weasel).—Abundant.

M. Canadensis (The Fisher).—Does not seem to be very abundant, but the Indians always bring to market a few of their skins when they return from their hunts.

Mephitis Americana (The Skunk).—Not uncommon, and sometimes killed by hunters for its skin, which is used for making sleigh robes.

Lutra Canadensis (The Canada Otter).—Very abundant along every stream. One of our Indians told me that he once secured three otters of large size, with one shot. He said, that after watching for them some time, they all came up together through a hole in the ice, when he aimed at the middle one and killed it on the spot, only a few grains of shot striking the other two, who immediately set on one another, as though mutually supposing each other to be the cause of their pain, and during the combat he dispatched them both with his tomahawk.

Canis lupus (The Common Wolf).—I was informed by the Indians that the wolf does not come farther north than the St. John River, where they are sometimes seen in small packs, and destroy the young moose.

C. fulvus (The American Fox).—Three varieties of the fox, the black, silver-grey and yellow, exist thoughout the district.

Lynx Canadensis (The Loup-cervier or Canada Lynx)—Abundant, and much sought after by the hunters.

Phoca — ? (Seal).—A seal generally of a mottled grey colour, ascends the St. Lawrence beyond Cacouna. Farther down the river, we sometimes saw, during summer, quite a number of them swimming together.

Castor fiber (The Beaver).—Formerly when the fur of the beaver brought such a high price, they were very much hunted in this part of the country, but since it has fallen tò less than quarter of what it was, the Indians do not kill them, except when an opportunity of shooting one accidentally falls in their way, and they consequently now re-occupy, often in great numbers, the places which they had long deserted.

Fiber zibethicus (The Musk-Rat.)—This animal, so abundant in all other parts of Canada, is likewise so, in the lakes and quiet streams of our present district.

Mus musculus (The Common Mouse)—Infests barns in the summer time.

Pteromys volucella (The Common Flying-Squirrel).—Rare.

Sciurus (*Tamias*) *Lysteri* (The Chip-munk).—Rare also.

S. Hudsonius (The Red Squirrel).—Abundant throughout the whole district.

Hystrix pilosus (*dorsata*) (The Canada Porcupine)—Appears to be much more abundant in the north-eastern part of the district (Gaspé) than in the counties of Rimouski, or Bonaventure. They become light grey or almost white when very old, but are said to be the same colour all the year round.

Lepus Americanus (The American Hare).—Notwithstanding its numerous enemies, is probably the most abundant quadruped in the woods.

Cervus alces (The Moose Deer or Elk).—For the last few years most of the hunters have devoted their time to killing the moose simply for the sake of their skins, which now command a higher price than formerly, and this they do at any season of the year which suits their own convenience. We were informed, that a party of these hunters had procured 300 skins the previous winter, and that another party of only three Indians had killed during the same season between 90 and 100 on one expedition, as many as six sometimes falling a prey to them in one day, yet still these noble animals roam in vast numbers over the district.

C. tarandus (The Caribou).—Very numerous about the Shick Shock Mountains. Some of our party, who were on the extensive flat top of Mount Albert, one of this range, reported that there, an area of great extent was strewn with vast quantities of fragments of their horns, most of which gave evidence of great antiquity.

AVES.

Haliætus leucocephalus, Linn. (Bald Eagle).—Immature individuals frequently seen from Green Island to Martin River, in June and July, and an adult on the Ristigouche, August 31st. At St. Anne, on June 17th, I saw one of this species flying off with a long string of seaweed entangled in its claws, and on the 30th at the same locality I observed a large eagle, which I took to be this species, and which, after hovering about for some time, dashed into the water at the mouth of the river, with such velocity that it entirely disappeared beneath the surface for some seconds, rising again with a fish of considerable size, apparently of the species commonly called the Sea Toad (*Cottus Grœnlandicus*) and flew off with it towards the mountains inland. I picked up wing-feathers of this species on several occasions on the shore, and at Green Island and Marcouin River I was shown wings of specimens which had been shot at those places.

Astur fuscus, Gmel. (Sharp-shinned Hawk).—Two specimens observed at Capuchin, about the clearings, in August.

Surnia funerea, Gmel. (Hawk Owl).—When at Green Island I was shown the head and wings of a specimen which was shot there about the middle of October.

Syrnium nebulosum, Gmel. (Barred Owl).—Occurred on the Marcouin River.

Chordeiles Virginianus, Briss. (Night jar, Mosquito Hawk).—Observed at Chatte River June 18th, Ste. Anne, June 28th to July 17th, and at the mouth of the Matapedia August 28th. At Ste. Anne July 17th, I was shown the eggs of this species deposited on the bare ground without any attempt at a nest. The parent bird was sitting on them, and although very frequently disturbed for some days, and her eggs much handled, one having been even cracked, she made no attempt to remove them, as this bird is said to do on similar occasions, and she invariably returned to the nest, as soon as we left the spot, propably because the eggs were nearly hatched. She appeared incommoded by the day-light, and permitted us to approach very closely before she took to flight.

Hirundo bicolor, Vieill. (White-bellied Swallow).—Very abundant at Cape Chatte and Ste. Anne, June 28th and 30th, and at Martin River July 20th. This species breeds in holes in decayed trees standing on clearings, in vast numbers at the above localities.

Hirundo fulva, Vieill. (Cliff Swallow).—Numerous at Metis, at the beginning of June.

Hirundo rustica, Linn. (Barn Swallow).—Abundant at Trois Pistoles, where they were building their nests under the eaves of a store, May 30th, also observed at Metis, June 10th, and near Long Point, June 15th.

Hirundo riparia, Linn. (Sand Martin).—A few observed making holes in a sand cliff on the banks of the river at Ste. Anne, June 28th.

Sylvicola coronata, Lath. (Yellow-crowned Warbler.)—One shot at Green Island Village, May 25th.

Troglodytes hyemalis, Vieill. (Winter Wren).—Observed on the Patapedia River, September 5th.

Parus atricapillus, Linn. (Black-cap Tit).—First seen on the Patapedia, September 5th, afterwards frequently observed in various localities.

Regulus satrapa, Lich. (American Golden-crest).—Several specimens were obtained at Rivière du Loup, May 18th.

Turdus migratorius, Linn. (Robin).—Numerous at Rivière du Loup, Cacouna, Metis, Matanne, Long Point, Chatte River, Ste. Anne, Marcouin and Matapedia rivers. At Marcouin river, July 24th, I observed numerous young birds feeding on the maggots and grubs in rotten fish.

Anthus Ludovicianus, Lich. (American Pipit).—Abundant, running about on low flats near the sea shore at Rivière du Loup, May 10th and 20th, Cacouna May 22d, Green Island Village, May 25th, and Rimouski June 5th. The colour of this bird so exactly resembles the tint of the low, wet ground, stained yellowish with iron, and covered with withered herbage, where it resorts in immense numbers, that although hundreds were running around me, I could distinguish none till they rose in the air.

Alauda alpestris, Linn. (Shore Lark).—In large flocks on the stubble in the wheat fields at the beginning of October, about Rimouski.

Plectrophanes nivalis, Linn. (Snow Bunting).—Large flocks at Kamarouska at the beginning of November. Mr. Richardson

captured a specimen alive, which had been injured by flying against the Telegraph Wire.

Emberiza socialis, Wils. (Chipping Bunting).—Common at Rivière du Loup, Rimouski, Long Point, and Chatte River.

Niphœa hyemalis, Linn. (Common Snow Bird).—Abundant from Rivière du Loup to Martin River, and at Little Lake Matapedia. I saw young birds full grown at Ste. Anne, July 15th, and found a nest containing 4 eggs, July 17th.

Carduelis tristis, Linn. (Yellow-bird or Goldfinch).—Common at St. Fabien and along the coast to Martin River.

Fringilla Pennsylvanica, Lath. (White-throated Sparrow).—Very numerous everywhere about the clearings along the coast. I found a nest containing four eggs near Long Point, June 16th. It was on the ground and composed of dry grass. The eggs were bluish with some dull red spots at the larger end.

Erythrospiza purpurea, Gmel. (Purple Finch).— One specimen observed at St. Fabien, May 30th, and flocks were seen at Ste. Anne, July 18th.

Agelaius phœniceus, Linn. (Red-winged Starling, " Blackbird"). —Two seen at Ste. Anne, July 17th.

Quiscalus ferruqineus, Lath. (Rusty Grakle).—Numerous flocks seen in the clearings along Metis River, and between Metis and Rimouski, in September and October.

Corvus Americanus, Aud. (Common American Crow.)—Abundant all along the coast, feeding on *Littorina*, and digging up *Mya arenaria* at low tide. They frequently carry the latter a considerable distance from the water, and at Cacouna the empty valves were lying in great numbers on the cliffs in the vicinity of their nests. At Trois Pistoles I found an old nest nearly filled with the shells of *Succinea obliqua*, each having a hole picked in it. On one occasion having wounded a Crow, I tied him to t e root of a tree, and his outcries soon attracted an immense number of his fellows, several of which I shot. Near Green Island Village I saw a flock chasing a Fox round a field. At Cacouna, May 21st, I found two nests on Spruce trees, one contained 5 eggs nearly hatched, and as is usual with the eggs of ì e *C rvinæ*, they differed much in colour and markings. The other nest contained four unfledged young, two being much larger than the others. It was also an abundant bird on the Ristigouche in August.

Garrulus cristatus, Linn. (Blue Jay).—One seen at Little Lake Matapedia, August 19th.

Garrulus Canadensis, Linn. (Canada Jay, "Moosebird").—Very common all over the district in the Forest, often approaching within a yard or two of us, when at our meals, in its well known familiar manner. The Indians consider this bird one of their greatest annoyances, as it steals the bait from their traps, and devours their moose-meat when hanging up to smoke. One of our Indians told me, that the preceding winter, while in the act of skinning a deer one of these birds commenced feeding on the flesh, and he split its skull with his knife.

Bombycilla Carolinensis, Briss. (Cedar Bird).—Common at Metis, Ste. Anne, and at the mouth of the Marcouin river.

Sitta Canadensis, Linn. (Red-bellied Nuthatch). — Several observed August 19th, at Little Lake Matapedia, and one picked up dead near the foot of Big Lake Matapedia.

Trochilus colubris, Linn. (Humming-bird).—One seen at Metis about the middle of August.

Alcedo alcyon, Linn. (Belted King-fisher). — Abundant on every river and lake throughout the district, from May 19th to the end of September. A hole about three or four feet from the top of a sand cliff near the mouth of the River Ste. Anne, in which a pair of Kingfishers had their eggs, I found to be upwards of six feet in depth.

Picus pileatus, Linn. (Pileated Woodpecker, "Log-cock").—I was given a specimen which was killed near Green Island. The Indians report it to be rare in this district.

Picus villosus, Linn. (Hairy Woodpecker).—I shot a specimen at Ste. Anne, June 28th, and another I noticed on the 30th June at the same place, had its nest in a White Birch tree about 35 feet from the ground, and the young were distinctly heard. This Woodpecker was also observed between St. Fabien and Bic, Marcouin and Martin Rivers.

Ectopistes migratoria, Linn. (Passenger Pigeon).—Not very numerous, but a few seen at Chatte River, Ste Anne, Matanne and Metis. It was rather numerous in August between Metis and Matepedia Lakes, and on the Ristigouche.

Tetrao umbellus, Linn. (Ruffed Grouse, "Partridge").—Near Rimouski, but rather scarce.

Tetrao Canadensis, Linn. (Canada Grouse, "Spruce Partridge"). On the 25th June, I was shown one which was caught in a trap near Matanne. I observed several on the Marcouin River at the end of July, and on the 30th July we met an old Grouse with her

brood about half grown, which flew at us as we passed, exactly as a common hen would have done. A few occurred near the Matepedia Lakes, but it was by no means as plentiful as on the Magdalen River last summer.

Strepsilas interpres, Linn. (Turnstone).—Observed at Green Island October 26th.

Tringa pusilla, Wils. (Little Sandpiper).—Abundant at Rivière du Loup and Green Island in May, and at Chatte and Martin Rivers in July.

Tringa, ———— ?—A Sandpiper which Mr. D'Urban has been unable to identify, was shot at the mouth of the Marsoni river, August 4th.

Totanus solitarius, Wils. (Solitary Sandpiper).—One specimen shot August 31st, on the Ristigouche where it was abundant.

Totanus vociferus, Wils. (Tell-tale Tatler).—Many pairs seen at Rivière du Loup, May 20th.

Scolopax Noveboracensis, Gmil. (Red-breasted Snipe).—One specimen obtained out of a large flock near Green Island, May 25th.

Ardea Nycticorax, Linn. (Night Heron, "Swamp Hen").—Abundant in the swamps near Dalhousie, N.B., also observed on the Patapedia and near Lake Metis.

Anser Canadensis, Linn. (Common Wild Goose).—Abundant at Rimouski at the beginning of June, near Chatte River June 17th, and in vast flocks near Green Island and Cacouna at the end of October.

Anser leucopsis, Bechst. (Barnacle Goose, "Berneche" of the Canadians).—Great numbers were passing down the coast when I was at Rimouski on 1st October, and I saw many that were shot by the numerous gunners stationed on the quay over which the Geese passed in their course, and they were also numerous at the end of the month at Green Island.

Fuligula Fusca, Linn. (Velvet Duck).—Numerous flocks observed along the coast from June 17th. Dead specimens were picked up on the sea shore near Ste. Anne in July.

Fuligula perspicillata, Linn. (Surf Duck).—I was given the stuffed head of a specimen killed at Green Island, I also noticed it in a collection of Bird skins, made by Pierre Fortin, Esq., J. P., commanding the Government Schooner "La Canadienne," on the coast of Labrador.

Fuligula clangula, Linn. (Golden-eyed Duck).—Numerous

near Bic and Green Island in October. One killed on Metis Lake September 18th.

Fuligula histrionica, Linn. (Harlequin Duck).—One killed at Ste. Anne, several on the Ristigouche, August 26th, and on the Patapedia, September 7th.

Mergus serrator, Linn. (Red-breasted Merganser).—First met with at Ste. Anne, June 30th. Common on every river and lake, as well as on the coast, throughout the district, several young birds were killed on the Matapedia August 21st.

Phalacrocorax carbo, Linn. (Cormorant, "Mouniac" of the Canadians).—Very abundant between Bic and Green Island, middle of October.

Larus atricilla, Linn. (Black-headed Gull).— In great abundance along the whole coast. Several other species of Gull were observed, but no specimens were obtained.

Mormon Arcticus, Linn. (Puffin).—In Capt. Fortin's collection from the coast of Labrador.

Alca Torda, Linn. (Razor Bill).—With the last species.

Uria Troile, Linn. (Common Guillemot).—With the two last species.

Uria Grylle, Linn. (Black Guillemot).—Very abundant at Hare Island at the beginning of May, at Green Island at the end of that month, and at Ste. Anne, and near Martin River in July. At the last named locality a fisherman informed me, that they generally lay three eggs, but that he has found five in one nest. On our return to Green Island, October 26th, it was still numerous there.

Colymbus glacialis, Linn. ("Loon").—Observed at Rimouski, Marcouin River, and on Lake Metis.

Colymbus septentrionalis, Linn. (Red-throated Diver).—Anticosti, Mr. Richardson, 1856.

REPTILIA.

Reptiles appear to be very scarce in this district, and the three following species so widely distributed over Canada were the most frequently met with :

Tropidonotus sirtalis, Linn. (Striped or Garter Snake).

Rana pipiens, Gmel. (Leopard Frog).

Salamandra, (*Plethodon*) *erythronota*, Green, (Red-backed Salamander.)

PISCES.

For the scientific names of several of the fishes mentioned in the following list, I am indebted to Principal Dawson, of McGill College, who kindly favoured me with a list of those which I had preserved in spirits; but of many common species I did not preserve specimens, and mention them here merely to note some fact connected with their history in our waters.

Gasterosteus biaculeatus, (Three-spined Stickleback).—In the greatest abundance in small streams, ponds, ditches, &c., near the shore. I also found a specimen among some trout, caught in a net in Lake Matapedia, which magnificent sheet of water is about 500 feet above the sea.

*G. pungitius?** (Ten-spined Stickleback).—Same habitat as the preceding species.

Cottus Grœnlandicus, (Sea Toad).—Very numerous in shallow water at fishing stations, where it seems to feed on the offal thrown into the water.

C. ————, (Fresh-water Bullhead).— Ristigouche River and Metis Lakes.

Scomber vernalis, (The Mackarel).—Is said to ascend the river no farther than Rimouski; but is not abundant for a considerable distance farther down.

Salmo salar, (The Salmon).—Ascends all the Rivers in the peninsula which are not shut up by mill-dams. The Ristigouche River and its tributaries are considered the best of all for salmon fishing, and the Ste. Anne of those on the south-east side of the St. Lawrence.

S. fontinalis, (Common Brook Trout).—Very abundant in every stream and lake, often at a great height above the sea, and in apparently inaccessible places.

S. trutta, (The Sea Trout).—The same fish as that referred to on page 97 of this volume, is abundant for a short distance up all the streams in Gaspé, and is also caught in gill nets set at right angles to the shore near the mouths of the rivers.

Osmerus viridescens, (The Smelt).—Caught in the fisheries along with sardines. They are also taken very readily with the hook and line.

Alosa præstabilis, (Common Shad)—Taken in brush fisheries, and cured in considerable numbers.

* (?) *G. Dekayi*, Ag.

A. tyrannus, (Alewife).—One specimen procured at Rimouski.

Clupea virescens? (Sardine).—These little fish are taken in great quantities in the fall of the year in brush fisheries along the shores of the St. Lawrence as far up as the salt water extends.

C. elongata (Common, Herring).—The herring fishery is not much attended to on the south-east side of the St. Lawrence, although the fish are very abundant. In spring they are largely taken at some places in brush fisheries, and sold fresh for a few pence per bushel; often for nothing else but to manure land.

Mallotus villosus, (The Capelin).—Prodigiously abundant along the whole coast during the fore part of summer, and are taken in immense quantities in brush fisheries, and with scoop nets for manuring land and for bait for cod. There is one of these brush fisheries at almost every second house, each of which takes enough, not only to supply the owner with an abundance of manure, but also some of the farmers in the back concessions, who depend upon him for their supply. It is a wonder that any of the unfortunate capelin escape at all, considering the vast number of these set to intercept their progress. I was informed, on good authority, that 40 cart loads (8 bushels each) were frequently taken out of one of these enclosures. Every family along the coast has a number of scoop nets, made by placing a fine meshed net between the prongs of a forked stick, with which they dip great quantities of capelin out of every shoal they see passing by their part of the beach. On the 11th of June, I saw 15 men engaged at this work, in one place, where a great shoal was kept close against the shore by the waves. They were standing in the water dipping them ashore, while a number of carts were busily engaged in drawing them off, the women and children assisting to load them. There were at least 200 bushels lying on the beach at the moment we visited the spot, and they said that they had been engaged at the same werk nearly the whole day. One of these men told me that this was nothing to what was sometimes done, and added that he had seen 3000 bushels taken in a day by the inhabitants of one place.

Ammodytes Americana, (Sand Launce).—Abundant, and used for bait for mackarel, in the stomachs of which they are frequently found.

Morrhua Americana, (Cod).—I was informed that the extreme height to which the cod ascend the St. Lawrence was Apple Island, not far from Trois Pistoles, and that some seasons they did

not go so far. They are plentiful as far up as Rimouski, and are caught abundantly, of large size, at Metis, where a considerable fishing is done about five miles from land. To these upper limits they follow the capelin in spring, but remain after they have disappeared.

M. æglefinus, (The Haddock).—Taken with cod at all the fishing stations, and a few are sold mixed up with them; but when sold separately they bring a much lower price.

M. pruinosa, (The Tomcod).—Plentiful in the mouths of rivers from the county of Rimouski upwards. This is the same fish which is taken in such great abundance at Three Rivers during the winter.

Motella cimbria? (The Four-bearded Rockling).—One specimen from Ste. Anne. This appears to be the first time the occurrence of this species has been noted on this coast.

Zoarcus viviparus, (The Viviparus Blenny).—A Blenny which cannot be distinguished from this species, was caught in the dredge in deep water off Marcouin, which is, I believe, the first time it has been found in the Gulf.

Hippoglossus vulgaris, (The Halibut).—These large fish ascend the St Lawrence as far as Green Island, and are caught in considerable numbers at all the fishing stations. I was informed that they were sometimes caught between six and seven feet in length; but I never saw one quite so large, although they generally attain a considerable size.

Spinax acanthias, (Spinous Dog-fish).—At Les Islets I saw a spinous shark, which, I have no doubt, from my notes, was this species. It was a very large specimen, and was brought ashore by some men, who caught it when fishing for cod.

Raia radiata (Starry Ray).—Occasionally caught with codfish at Ste. Anne. A hunter here cures the flesh of the starry ray, with which he baits his traps in winter, and says that it is preferable to any other for some animals.

Salmo.—A fish of this genus, called by the Indians "Toag,' and by the French Canadians "Touradi," exists in great numbers in all the larger lakes, but are said never to be found in any of the rivers. In the Metis Lakes they are said to be of the same average size as the salmon, and are taken in winter by dropping a line through a hole cut in the ice. A settler at Lake Metapedia told us that he could spear enough of them in two nights to last his family all winter. They are of a much darker colour than

the salmon trout. The head is large, and the body tapers regularly to the tail. The flesh is of a yellow colour, and for the table is equal to the salmon. In the Metis Lakes there are, besides "Toag" and a large red variety of *S. fontinalis*, called "Rag," at least two other species of the genus Salmo.

Coregonus.—A species of herring trout, probably *C. clupeiformis*, abounds in the deep clear water of the Metis Lakes. Our Indians informed me that in the fall immense shoals of them approach the shores of the lakes, and that hundreds of barrels might be taken with a seine.

Cyprinus.—A species of chub, with very large scales, was abundant in Lake Metapedia and elsewhere.

Catastomus.—Black suckers were abundant in the Restigouche River and the larger lakes, but as I did not preserve specimens I could not be certain of the species.

Anguilla.—Eels, probably *A. acutirostris*, are abundant about the mouths of all the rivers, and toward the upper limits of the salt water are barrelled in considerable quantities for the market. A thick short black eel is extremely abundant in the Metis Lakes and River. The remains of a contrivance for catching these fish, which was long ago built by the Indians almost across a narrow part of the lower Lake, are still in existence.

Platessa.—Flounders, or as the French Canadian fishermen called them *Plaise*, were taken in great abundance with cod lines at Ste. Anne and other places, and used for manuring land. Small flatfish are also taken among shoals of capelin.

INVERTEBRATA.

CRUSTACEA.

Hyas fissirostra ?—A spider crab agreeing with Say's description of *Lissa fissirostra* and DeKay's *Hyas coarctata*, (but not however with Bell's description under the same name,) in fishing grounds of moderate depth, and especially at Ste. Anne, and were devoured in great numbers by almost all kinds of fish. In the stomachs of halibut some very large specimens were procured, but the largest of all were caught by fishermen with cod hooks. The carapace of one of these measures 4 inches from the anterior to the posterior extremity. This is quite a different crab from the large *Maia*, parts of which Principal Dawson obtained in Gaspé Bay.

Cancer irroratus.—This is probably the most abundant crab in the Gulf. The breadth of the carapace of the largest specimen in the collection is 4½ inches.

Pagurus Bernhardus.—Abundant in shells of Natica, Buccinum, Fusus, &c.

Homarus Americanus.—Lobsters are rare on the south-east side of the St. Lawrence, but very abundant on Anticosti and in the Bay of Chaleur as far up as Dalhousie, and Principal Dawson mentions them as being likewise abundant in Gaspé Bay.

Astacus Bartonii.—The common crawfish is abundant in the Matapedia, Restigouche and Metis Rivers, and in 1857 I found a specimen just below the high falls of the Ouiatchouan, which empties into the south side of Lake St. John.

Crangon vulgaris.—Although the common shrimp is abundant in the St. Lawrence, and largely devoured by the cod, the fishermen have not yet got into the way of using them for bait.

C. sculptus.—A specimen corresponding nearly with Bell's description of this, was caught in the dredge, off Cape Chatte.

Hippolyte (?).—A shrimp of this genus was dredged near Metis; but the specimen is so much damaged, that the species is not satisfactorily determined.

Orchestia (?).—A species of beach-flea swarms in all the pools left by the receding tide.

MOLLUSCA.

Gasteropoda (Marine).

Fusus scalariformis.—Peter River, Ste. Anne and Marcouin, in stomachs of haddock and flounders, and living specimens dredged in 60 fathoms at the latter place.

F. Islandicus.—Trent, Ste. Anne and Marcouin, not common.

F. tornatus (Gould).—Parts of large individuals were found on the shore at Rimouski, and complete specimens near Ste. Anne. This is the same species as the one so common in the Post Pliocene clays near Montreal.

F. decemcostatus.—Two good specimens in a collection of shells brought from near Cape Gaspé by Sir W. E. Logan in 1844.

F. rufus.—Numerous specimens from stomachs of fish at Ruisseau Vallée.

F. Bamffius.—Same source.

Pleurotoma bicarinata ?—One specimen from same source.

Buccinum undatum.—Whole coast from Rivière du Loup downwards; very abundant at low tide, and constitutes one of the principal articles of bait used by the fishermen after the capelin have disappeared.

B. Donovani.—Dead specimens were found at different parts below St. Flavie.

Nassa trivittata.—Plentiful in Bay Chaleur as far up as Dalhousie, but was not observed on the north coast of Gaspé, although it was found by Principal Dawson in Gaspé Bay.

N. obsoleta.—A number of specimens in Sir W. E. Logan's collection from the gulf.

Purpura lapillus.—Whole coast below Little Metis; extremely abundant and used as bait for cod.

Trichotropis borealis.—Dead specimens obtained at Ste. Anne and near Cape Chatte.

Velutina haliotoides (*lævigata*).—Ste. Anne, in stomachs of flounders, rare; living specimens dredged in deep water off Marsoni.

Lamellaria perspicua.—Ruisseau Vallée, one specimen amongst fish offal.

Natica heros.—Large and abundant in the sandy coves along the Gaspé coast. Great numbers of them of small size were found on the beach near Dalhousie, N.B.

N. clausa.—Collected on the shore at Bic and St. Luce, and found plentifully in stomachs of fish at Capuchin, Ste. Anne, Ruisseau Vallée and Marcouin.

N. triseriata.—I found this species in Magdalen Bay in 1857, but never in any other place.

N. flava ?—Rimouski, Les Islets and Glande.

N. helicoides.—Marcouin, in stomachs of haddock.

Rostellaria occidentalis.—Incomplete specimens common at Bic. A young specimen was procured at Glande, and a perfect one at Ste. Anne.

Rissoa minuta.—Green Island and Long Point, abundant.

Lacuna vincta.—Very abundant from Rimouski downwards.

Littorina palliata.—Whole coast from Rivière Ouelle downwards. At Dalhousie they are of a beautiful clear yellow colour.

L. rudis including *tenebrosa* which may be only a variety.—Whole coast.

Margarita cinerea.—Obtained in considerable numbers from stomachs of flounders and haddock at Ste. Anne, and a few from the same source at Marcouin, Ruisseau Vallée and Peter River.

M. undulata.—In fishes stomachs at Ste. Anne and Ruisseau Vallée. but not so plentiful as

M. helicina.—Trent, Les Islets and Ste. Anne, abundant.

*Skenea costulata.**—A specimen of this beautiful little species was found by Principal Dawson in examining some of the material which was dredged in deep water off Marcouin.

Diadora noachina.—Plentiful in stomachs of haddock taken at Capuchin, Ste. Anne and Marcouin, also dredged in consider- numbers at the latter place.

Crepidula fornicata.—One specimen found at Dalhousie, N.B., very abundant at Carraquette.

C. plana.—Carraquette.

Acmæa (Lottia) testudinalis.—Dead specimens common at Rivière du Loup, but first found alive near Trois Pistoles; very abundant along the whole coast and in Bay Chaleur. At Les Islets where the water inside of the islets becomes by the heat of the sun percetibly warmer than that outside, these shells exist in immense numbers and attain the diameter of 1 inch and 7 lines.

A. cæca.—Numerous dead specimens dredged at Marcouin.

Chiton marmoreus.—One large specimen found at Bic; numerous on stones and dead shells dredged off Ste. Anne and Marcouin. and found in fishes' stomachs at coves on the Gaspé coast.

(Fresh Water.)

Planorbis trivolvis. — L'Orignal on the Ottawa, Lachine, Montreal, and in the Rimouski, Metis and Ristigouche Rivers: found also, in 1857, in Lake Kenogami, between Chicoutimi and Lake St. John, at the head of the Saguenay.

P. campanulatus.—Renfrew on the Bonnechere River, Montreal, and in shell marl from near Philipsburgh, St. Armand and St. Rose, Terrebonne, and living in Lakes Metis and Matapedia.

P. bicarinatus.—Renfrew, L'Orignal, Montreal, in marl from Ste. Rose, Shefford Mountain and Carleton, Bay of Chaleur, also living in the Ristigouche River.

P. lentus.—Renfrew and near Montreal.

P. parvus.—L'Orignal and Montreal, in marl from Anticosti and several localities in the Eastern Townships; inhabits still water throughout the whole of the Peninsula of Gaspé.

Physa heterostropha.—Mississippi River, L'Orignal, neighbourhood of Montreal, Eastern Townships, and along the south-east side of the St. Lawrence below Quebec as far down as Gaspé Bay. They seem to thrive as well and grow to as large a size in Gaspé as anywhere else. I found a few Physas in some shell marl from Anticosti, which appear to belong to this species.

* Forbes & Hanley, Vol. III. 167; Vol. IV. 271.

P. aurea.—L'Orignal and Carillon on the Ottawa, Lachine Canal, Montreal, and several localities in the County of Rimouski.

P. ancellaria.—L'Orignal and near Rimouski village.

P. elongata.—L'Orignal, Montreal, Green Island, Metis and Ste. Anne (Gaspé.)

Limnæa megasoma.—This fine species was found by Mr. Billings in the Bonnechere River, and by myself in a creek near Hawkesbury Village, where it was rather abundant.

L. jugularis (*stagnalis*).—Plentiful in many streams and small lakes on the south side of the Ottawa and in the St. Lawrence near Montreal, and extremely abundant in the Metis Lakes in the county of Rimouski.

L. caperata.—St. Lawrence near Montreal, and very plentiful in Lake, Matapedia.

L. umbrosa.—Common in ponds between Montreal and Lachire, and near Ste. Anne, (Gaspé) at which place I found an individual having its aperture turned to the left side.

L. elodes.—This is by far the most common Limnæa inhabiting stagnant waters in the Ottawa valley and about Montreal, but as it is a variable species, I am uncertain whether it occurs or not among those collected below Quebec.

L. catascopium.—Rimouski, Ristigouche and Dartmouth Rivers.

L. opacina.—St. Lawrence, between St. Nicolas and St. Antoine; alive and pretty abundant at low tide at Point Levi, in the Metis River above the high fall, Rimouski and White Rivers.

L. acuta.—This is the most abundant species in the shell marl from Marl Lake, Anticosti.

Ancylus rivularis.—Old quarries near the mile end toll-gate, Montreal.

Paludina decisa.—South Nation River, L'Original, Lachine Canal and St. Helen's Island.

Melania acuta.—St. Lawrence, near Montreal and Varennes.

M. Niagarensis.—Same localities.

Amnicola porata.—Occurs in marl from the Lachine railway and Shefford mountain, and was found living in Little Lake, Matapedia (County of Rimouski.)

Valvata tricarinata.—Abundant in marl from Philipsburgh, St. Armand and the Lachine railway, and inhabits Lake Matapedia.

V. sincera.—Marl Lake, Anticosti.

(Terrestrial.)

Helix alternata.—This is perhaps the most widely diffused species of the land snails found in Canada. It occurs abundantly on both sides of the Ottawa, at Montreal, Point Levi opposite Quebec, and down the south-east side of the St. Lawrence into Gaspé, and is common over the whole peninsula as far as my observations extended, at Dalhousie, N.B., and along the Ristigouche River.

H. albolabris.—One of the most common species in the Ottawa Valley, at Montreal and Point Levi, but does not extend so far down as the County of Gaspé, having been last observed on the coast of Metis. It was, however, found at Lake Matapedia, 25 miles south-east of Metis, and was extremely abundant at Dalhousie and along the Ristigouche as far up as the mouth of the Patapedia.

H. monodon.—Very abundant under stones in pasture fields near L'Orignal and in the augmentation of Grenville, Montreal mountain, Point Levi under decaying leaves lying on disintergated shale, but was not found further down the St. Lawrence. Not having collected a single individual of this species during the previous part of the summer while travelling in the northern part of the district, I was astonished on coming to the Ristigouche to find them in the greatest profusion in many places along that river, as well as at Dalhousie.

H. exoleta.— One specimen found on the Ristigouche about five miles above the mouth of the Matapedia.

H. tridentata.—Montreal mountain, rare.

H. concava.—A few specimens found near L'Orignal and on the Montreal mountain; plentiful at Point Levi.

H. hortensis.—It seems scarcely credible that this species has been imported from Europe, considering how widely diffused and vastly numerous it has become along the Lower St. Lawrence. On the main land it was first observed on Mount Commis, about nine miles south of St. Luce and on the coast at Metis, where it was abundant, and below which it seems to occupy the place of *H. albolabris*, but is generally much more numerous. In 1857 I found vast numbers of them on the Brandy Pots and Hare Island in the middle of the St. Lawrence opposite Rivière du Loup. The climate of Gaspé seems to be very favourable to their propagation, as they appear to have spread over the country for a considerable distance inland. The yellow and banded varieties

seem to be about equally numerous. Where land has been recently cleared and burnt over, their withered shells may be seen strewed in thousands over the surface of the soil. In the valley of the Marcouin they were observed to extend 12 miles inland, which was farther than at any other place. The height at which the last specimen was found was about 1500 feet above the sea, as indicated by the barometer which we had with us. The young from the size of a grain of duck shot to half that of the adult shell were met with in our journey up this valley in the end of July.

H. arborea.—This and the next species are probably the most abundant snails in the Ottawa valley and all along the Lower St. Lawrence from Kamouraska to Gaspé Bay, and in every part of the peninsula which we visited, and also around Lake St. John at the head of the Saguenay. Both these species exist on the Island of Anticosti, as I found specimens of them imbedded in fresh-water shell marl which Mr. Richardson brought from there in 1856. They are amongst the commonest land shells at Montreal and Point Levi, although they may not appear to be so owing to their small size.

H. striatella.—Found everywhere with the preceding species.

H. lineata.—L'Orignal, Augmentation of Grenville, Carillon, Montreal Mountain, and in many localities along the St. Lawrence from Berthier to Marsoni River, Gaspé.

H. labyrinthica.—L'Orignal, Rivière du Loup (en-bas), Green Island, and a few localities in Gaspé.

H. pulchella.—Carillon, Montreal, Berthier, mouth of Magdalen River and Dalhousie.

H. electrina.—Carillon.

H. chersina.—L'Orignal, Trois Pistoles, Ste. Anne, Marcouin, Magdalen River and mouth of the Matapedia.

Bulimus lubricus.—Montreal, Rivière du Loup, Trois Pistoles, Metis Lakes and Campbellton, mouth of Restigouche River.

B. harpa.—Metis, mouth of Magdalen River, and very abundant in the Marsoni valley.

Vitrina pellucida.—Rivière du Loup, Trois Pistoles and Ste. Anne.

Succinea ovalis.—L'Orignal, Metis, Matan and Ste. Anne.

S. avara.—L'Orignal, Matan, mouth of Magdalen River, and along the Ristigouche, near the mouth of the Patapedia.

S. obliqua.—Abundant in the Ottawa valley, at Montreal,

Point Levi, all along the south-east side of the St. Lawrence from Rivière du Loup to Gaspé, and in nearly every place examined in the interior of the peninsula or on the Ristigouche.

Acephala (Marine).

Pholas crispata.—Dead specimens were found at Bic Harbour, Rimouski, and near the Trent.

Saxicava rugosa.—Abundant living in stiff mud at Les Islets and at Ste. Anne in Limestone, nullipore and the roots of a large green sea weed with perforated fronds (*Agarum Turneri*). Empty specimens were collected at Cape Chatte, Marsoni and Glande.

Mya arenaria.—Found abundantly in every favourable locality along the whole coast. In ascending the river they gradually become smaller as they approach the fresh water, and probably extend only a short distance above Rivière Ouelle, where, after searching for some time I found only one small living specimen. In the Bay of Chaleur they seem to be as large as on the north coast of Gaspé.

M. truncata.—Fresh valves numerous along the shore at Bic, Rimouski and St. Luce. Numbers of fine specimens found at different places between Metis and the Trent; valves dredged at Ste. Anne and Marcouin.

Glycimeris siliqua.—Cape Chatte, Ruisseau Vallée and Marcouin.

Osteodesma hyalina.—Ste. Anne, several very fine specimens from stomachs of flounders.

Machaera costata.—Very common at Rimouski.

Solen ensis.—Bic, Rimouski, St. Luce, Cape Chatte, Ste. Anne, and extremely abundant at Grande and Peter Rivers.

Tellina proxima (*calcarea*).—Ste. Anne, Ruisseau Vallée and Marcouin, stomachs of haddock.

T. Groenlandica.—More or less abundant along the whole coast. In 1857 I found this species at Bay St. Paul, on the north-west side of the St. Lawrence only, about 55 miles below Quebec, which is probably the nearest approach of the living marine shells to their fossil ancestors in the Post Pliocene deposits in the Ottawa Valley, some of which are nearly 400 miles distant.

Mactra ovalis (*ponderosa*).—First met in Bic Harbour, but becomes very abundant at Rimouski, 12 miles farther down. Occurs at Metis and Ste. Anne, and in the coves at the mouths of Marcouin, Glande and Mont Louis Rivers.

Mesodesma arctatum.—Dead specimens were found as far up

as Green Island, and the first living ones at Bic. This species probably ranks next to Mytilus edulis, in abundance along the south-east side of the Lower St. Lawrence. In an ancient sea beach between Metis and the Trent, about 15 feet above the present sea level, these shells are found in heaps and mixed with sand and fragments of other shells, the same as along the present shore. some imperfect valves were found at Matan in a bed of sand near the top of the 50 feet terrace occurring there.

Venus mercenaria.—Specimens in Sir W. E. Logan's collection from the Gulf; occasionally found among oysters from Carraquette.

V. gemma.—Very abundant at low tide in coarse sand around the islets between Green Island and the main land.

Aphrodite Groenlandica.—Abundant at Bic and Rimouski. At the latter place a fine specimen more than three inches long was procured. Plentiful in flounders stomachs at Metis, Ste. Anne and Ruisseau Vallée.

Cardium Islandicum.—A valve was found in Bic Harbour, and another at Rimouski. Common in stomachs of flounders at Metis and Ste. Anne, these shellfish, which were sometimes found alive in their maws, seem to constitute their principal food ; their average size was two inches in length.

Cardita borealis.—Dredged at Marcouin and found in fishes maws at Capuchin, Ste. Anne and Ruisseau Vallée.

Astarte sulcata.—Rare at Bic Harbour, Cape Chatte, Ste. Anne and Rouisseau Vallée, but was one of the commonest shells dredged in 60 fathoms off Marcouin. Among the Marcouin dredgings were a number both of living and dead specimens of a variety or perhaps a distinct species which bear a very close resemblance to A. Laurentiana, the common species of the Post Pliocene deposits near Montreal, and which differs in many respects from A. sulcata.

Lucina flexuosa.—Ste. Anne, Ruisseau Vallée and Marcouin ; stomachs of haddock.

Lima subauriculata.—One specimen of this rare and beautiful species was found in the stomach of a haddock at Ste. Anne.

Mytilus edulis.—Found farthest up the St. Lawrence at Kamouraska and gradually becomes more abundant in descending the river. The largest individual found on the Gaspé coast is $3\frac{3}{4}$ inches long. In the Bay of Chaleur they are much wider posteriorly than in the St. Lawrence, they resemble the fossil variety, but are generally either straight or concave along the ventral margin.

Modiola discors (Linn.) *discrepans* (Lam.)—Ste. Anne, found in great numbers adhering to the roots of large Algae (*Agarum Turneri*) which were thrown up on the beach by a violent storm. As many as a dozen individuals were sometimes attached to the base of the same sea weed, each completely enveloped in its great bissus. Of about 200 specimens which I obtained in this way, the largest is 1 inch, 5½ lines long and 10 lines high. The large shells are of a very dark colour. Some living specimens were dredgd in the Marcouin cove.

M. plicatula.—Numerous specimens in Sir W. E. Logan's colection from the Gulf.

M. Glandula.—Common in stomachs of flounders and haddock at Ste. Ann, Ruisseau Vallée and Marcouin, and many living specimens were dredged in about 60 fathoms off the latter place.

M. pectinula.—Three specimens were obtained among fish offal at Ruisseau Vallée.

M. nexa, (Gould).—Ruisseau Vallée, one specimen from same source.

Leda limatula.—Very abundant in stomachs of flounders and haddock at Capuchin, Ste. Ann, Ruisseau Vallée, Martin and Marcouin Rivers.

Nucula tenuis.—Capuchin, Ste. Ann, and Ruisseau Vallée, in stomachs of haddock, rare.

Pecten Magellanicus.—Glaude River, Gaspé. Fragments of valves were collected at Ste. Ann and two specimens obtained from fishermen of the same place who brought them from the north shore directly opposite. In 1844 Sir W. E. Logan brought a great number of specimens of this species from the neighbourhood of Cape Gaspé.

P. Islandicus.—First occurs near Metis where numbers are frequently found in fishes' stomachs. While at Ste. Ann, I collected upwards of 170 specimens of this species, presenting a great variety of beautiful tints of red and pink colouring, from the stomachs of flounders which the inhabitants had taken when fishing for cod, and spread on their fields for manure. The fishermen frequently haul up large and beautiful specimens on their hooks with the valves closed on the bait. Some good living specimens were dredged at Marcouin in about 30 fathoms, and they were found in abundance in the stomachs of flounders at all the coves visited on the coast below Ste. Ann. The largest specimen from Ste. Ann is 3 inches and 8 lines in height and there are a

number more nearly as large, I have also a specimen from the Island of Anticosti.

Anomia ephippium.—Ste. Ann, adhering to the dorsal valves of Pecten Islandicus; also dredged at Marcouin.

Terebratula * *psittacea.*—Common in the stomachs of flounders and haddock at Ste. Ann. At Ruisseau Vallée I procured more than 130 fine specimens of this shell in a spot where there had been a heap of fish offal, but all the soft matter having decayed away, nothing remained but the bones of the fish and the shells which their stomachs had contained. A considerable number of living specimens were dredged in 60 fathoms off the mouth of the Marcouin River. There were also many valves and imperfect specimens in the material dredged here, showing that this species is very plentiful on the Gaspé coast.

Tunicaries of the genus Assidium were very common between Cape Chatte and Ste. Ann.

(Fresh Water.)

Unio radiatus.—Very abundant in the Ottawa and some of its tributaries from Ottawa City downwards in the Lachine Canal and the St. Lawrence in the vicinity of Montreal. Mr. Billings has a number of specimens of this and the next species from Lake Nipissing.

U. complanatus—Lake Nipissing, Ottawa River, Lachine Canal and the St. Lawrence as far down as Berthier below the Island of Orleans, where the last living specimen was obtained, but valves both of this and the preceding species were very frequently found on the beach all the way down to Gaspé. Abundant in Lake St. John, and said to inhabit the Little River St. Margarite on the north shore opposite Ste. Ann, Gaspé.

U. gibbosus.—Very abundant in the Ottawa at L'Origual, and on St. Helen's Island, Montreal.

U. ventricosus.—Bonechere and Ottawa Rivers, Lachine Canal and St. Lawrence near Montreal.

U. ellipsis.—Cullarie, (the channel between Calumet Island and the north shore of the Ottawa) and St. Helen's Island.

U. rectus.—Cullarie, Ottawa near L'Origual, Lachine Canal and St. Helen's Island.

U. alatus.—Common in Ottawa at L'Orginal, where I once caught a large specimen with a baited fish-hook in about ten feet of water.

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* (*Hypothyris.*)

Margaritana rugosa.—South Nation River, Lachine Canal and St. Helen's Island.

M. marginata.—Culbute and St. Helen's Island.

M. arcuata (margaritifera).—Green and Rimouski Rivers, Lake St. John and both the Matapediac Lakes.

M. undulata.—Culbute, L'Original and St. Helen's Island.

Anodouta subcylindracea.—Lachine Canal, Grand Lac about 10 miles south of Rimouski, a small lake 6 miles southwest of of Grand Metis, Lakes Matapedia and St. John.

A. pavonia.—Very abundant in the creek at L'Original and in old quarries near the mile end toll-gate, Montreal.

A. fluviatilis ?—Ottawa near L'Orignal and Lachine Canal.

Cyclas similis.—Very abundant in the creek at L'Original, Lachine Canal, Metis Lakes and a pond 6 miles S. W. of Metis.

C. Orbiculata.—St. Lawrence near Montreal.

C. Dubia.—Ottawa City, Carillon, Montreal, Point Levi, Mare Lake Anticosti, Eastern Townships, and throughout the eastern peninsula of Lower Canada.

Besides the above 128 species of recent shells occurring in Canada, there are in the collection of the Geological Survey many more, the names of which have not yet been determined. I hope to be able to give a list of these in a future number of the Naturalist. Principal Dawson has kindly undertaken to name the Tubicolae, Bryozoa, Foraminifera, &c., dredged on the north coast of Gaspé, and will publish a list of them in another number of this magazine.

(*To be continued.*)

ARTICLE XVII.—*Geological Survey of Canada.—Figures and Descriptions of Organic Remains.* Decades 1 and 4.

Decade 1st is the work of Mr. Salter, the excellent paleontologist of the Geological Survey of Great Britain, to whom, many years since, Sir Wm. E. Logan committed a collection of the remarkable silicified shells of Pauquette's Rapids on the Ottawa, and who accordingly now describes these shells, acting, as he says, as pioneer for Mr. Billings.

This decade commences very appropriately with the remarkable and mysterious *Maclurea Logani*, a shell in which the name of the father of American geology is associated with the greatest name in Canadian geology ; but which the zoologists have yet

failed satisfactorily to assign to its place in the system of nature. The genus belongs almost to the dawn of life on our planet, being found in the oldest silurians both in Europe and America. The species here described is a fine discoidal shell, looking like a broken volute from an Ionic column; but where one might look for the fractured surface, is a curiously marked spiral operculum or lid strongly marked with the apophyses, by which the ancient tenant held fast his door when pressed with danger from without. An ordinary observer might pass this shell as like a Nautilus or a Planorbis; but its flat lower side, its sunken upper side, and its singular operculum, strike the eye of a conchologist, and are unlike anything in the modern world. At present it is placed near to the *Atalantæ*, small thin shells inhabited by a peculiar tribe of sea snails (Heteropods). But the *Maclurea* was a thick heavy shell, and its animal, though, perhaps, more like the *Atalantæ* than other modern creatures, must have differed very materially from them.

In collections of tropical shells one sometimes sees specimens of the beautiful but fragile *Ianthinæ* or violet snails, which swim in immense multitudes on the ocean, floating by means of a singular raft of air vesicles secreted by the animals, and to the bottom of which their eggs are attached. In the old silurian seas multitudes of similarly constructed shells are found, probably inhabited by animals of like nature. They are usually, however, in a condition which does not admit of satisfactory examination, except as to the general external form. But in the limestone of Pauquette's Rapids the shell has been replaced by silica, and this when exposed by the weathering of the softer enclosing rock or by the action of an acid, represents the original organism as if just picked up on the beach. Many of the beautiful forms thus revealed are represented in this decade.

Other floaters of that period, but of somewhat higher organization, are represented by the genus *Cyrtoceras*, the floats of certain old cuttle fishes, which, perhaps, preyed on their Atlanta-like companions, as they no doubt devoured Paleozoic medusæ and other soft creatures, whose remains have perished. Other shells, bivalves of the genus *Ctenodonta*, humble burrowers and creepers like our *Arcas* and *Nuculas*, and fortified like them with a long row of interlocking teeth in the hinge, take us down to the oozy bottom of the Paleozoic seas, where also many univalves, not unlike modern *Littorinas* and *Pyramidellids*, — the *Cyclonemæ*, and *Loxonemæ*—creep and perhaps feed on sea weeds.

A very interesting point, which is the burthen of this decade, is the fact that in the limestone of Pauquette's Rapids, as elsewhere in Lower Canada, the fossils which in New York are divided among the Chazy, Trenton, Black River, and Birdseye limestones, co-exist in a single bed, indicating no doubt a greater uniformity in the condition of the sea bottom.

Mr. Salter's decade closes with a notice of a singular genus, which has hitherto puzzled paleontologists, the *Receptaculites*, long since figured by Hall in the fossils of New York, but of which new species have been found in Canada and Australia, Mr. Salter regards it, notwithstanding its comparatively gigantic size, as belonging to Foraminifera and allied to the genus *Orbitolites*. The conjecture is clever and not improbable; and, if true, it will not only give the Foraminifera a great antiquity, but show that, like some other families, they began to exist in gigantic forms unequalled by their degenerate successors.

Decade 4th is the work of Mr. Billings, and describes all "the crinoids of the silurian rocks of Canada, of which specimens have been procured, in such a state of preservation, as to admit of their being characterized";—about fifty species in all. Mr. Billings very properly prefixes to his description of the species, an introductory account of their organization, so plain and clear, that no one can find much difficulty in studying these curious fossils after reading it. The crinoids are stalked starfishes, of so curious and complex organization, that they attracted the popular fancy long before there was any science of geology. They furnished the old Britons with natural necklaces, and they have been known as "fairy stones," "St. Cuthbert's beads," "screw stones," "pulley stones," and lastly, as "stone lilies." When perfect, the typical crinoid presents a long flexible column or stalk made up of a series of flattened beads, curiously worked into articulating surfaces where they touch each other, and penetrated by a central perforation, through which extends a continuation of the body of the creature. On top of the stalk was a cup, made up of a number of ornamented plates, joined at the edges, and containing the viscera of the animal. From the edges of the cup sprouted forth jointed arms extending around and serving as organs of prehension; and in a cover of smaller plates, probably often flexible, was the mouth, extended sometimes into a tubular proboscis.

The particular description of their parts, given by Mr. Billings, is worthy of being extracted here, for the benefit of students and collectors.

I. *The Column or Stalk.*

"The column usually consists of a long and slender cylindrical stalk, composed of numerous short joints, so closely articulated together, that, during the life of the animal, it must have possessed a very considerable amount of flexibility. It seems probable that in species where the joints are alternately large and small, as in *Glyptocrinus*, there was a greater degree of pliancy than in those instances where it is formed of thin, equally large circular plates, as in the lower part of the appendage in *Rhodocrinus pyriformis*. In the Corniferous limestone smooth round columns one inch in thickness are often found, and these are so firmly constructed, that they must have stood upright, supporting the body of the Crinoid, as upon the top of a pillar. The columns are either pentagonal throughout their whole length, or pentagonal in one part and round in another, or altogether round and smooth. In all the species they are perforated from top to bottom by a small central canal, which is also either circular or pentagonal. This canal no doubt served the purpose of conveying the nourishment from the interior of the body to every part of the column, by which its growth was provided for. In nearly all Crinoids the lower extremity of the column was attached to the bottom of the sea or some other solid object, such as pieces of floating timber, either by a number of branching rootlets, as in *Rhodocrinus pyriformis*, or by a broad, solid base, as in *Cleiocrinus regius*. I think however that certain Lower Silurian species were free, and moved about through the water, dragging their columns after them. I have seen at least a hundred columns of *Glyptocrinus ramulosus* with the lower part preserved, and could never discover any signs of an attachment. In this species the column at the upper end is often half an inch in thickness, and it tapers gradually to half a line at the lower extremity, a short piece of which, when found perfect, is always closely curled up, like a miniature coil of rope. I think also that sometimes the attached species had their columns broken off by some accident, and that the animal lived long afterwards free, but with a portion still connected with the body. I have seen specimens of *Rhodocrinus pyriformis* with from six to ten inches of the column attached to the base of the cup, with the terminal joint where the fracture occurred rounded, and the alimentary canal closed, or, as it were, healed up. There does not appear to be any way of accounting for this condition of the column, unless upon the above supposition.

"The species of the genus *Comatula* now living, all of which are true Crinoids, are attached while young, but free in the adult state. The invaluable observations of Thompson on this genus will, as already stated, be found at the end of this Decade. The *Marsupites* of the Chalk which have no column were also free Crinoids."

II. *Side-arms or Cirri.*

"The side-arms or cirri are long, slender-jointed appendages, attached to the column, the purpose of which does not appear to be well understood. They have not yet been found on any of the Lower Silurian species. Some of them are represented in the figures given at the end of this Decade, in the article upon *Comatula.*"

III. *The Basal Plates.*

"The base of the cup consists of a set of plates arranged in a circle on the top of the column, and in some species where they are large constitutes a saucer-shaped support of the viscera, to the centre of the bottom of which support the column is attached. This part of the skeleton has usually been called the pelvis. In nearly all the Lower Silurian species there are five basal plates; in the Upper Silurian, species with three or four are not uncommon; while in the Devonian those with five plates are comparatively rare."

IV. *The Sub-radial Plates.*

"These are always five, and constitute a row resting upon the upper edges of the basals. They occur in the genera *Palæoncrinus*, *Dendocrinus*, *Porocrinus*, *Carabocrinus*, *Rhodocrinus*, and others. In *Glyptocrinus*, *Heterocrinus*, *Thysanocrinus*, *Hybocrinus*, and *Cleiocrinus*, there are no sub-radials, the rays springing immediately from the basals."

V. *The Rays and Radial Plates.*

"In all Crinoids there are five rays, the lower plates or extremities of which are included in the structure of the cup and form part of the shell, while the upper portions are prolonged above the body, and constitute the arms, which are generally free and more or less branched. In *Rhodocrinus* and *Glyptocrinus* each ray consists at first of a single series of three plates, sometimes called the primary radials or simply the radials; it then divides into two series, called the secondary radials. In these two genera the primary and secondary radials enter into the composition of the

cup. In *Glyptocrinus* the first or lowest primary radials rest upon the upper edges of the basal plates, alternating so that each ray is supported by the contiguous sides of two of the basals. In *Rhodocrinus* there is a series of sub-radials between the basals and primary radials. In such genera as *Palæocrinus*, *Carabocrinus*, *Dendrocrinus*, and *Porocrinus*, the first primary radial only is included in the walls of the cup, but the second plate and all above it are free. In the very remarkable genus *Cleiocrinus* the primary, secondary, tertiary, quaternary and quinary rays are all firmly connected together, the free arms commencing with the sixth or seventh division."

"The student will find many other modifications of the radial system of the Crinoideæ by consulting various palæontologists; but the above are the more common ones, and those most prevalent in the Lower Silurian of Canada."

VI. *The Inter-radials.*

"The divisional space between two rays is called an inter-radius; and as there are five rays, there must be of course an equal number of inter-radii. Four of these are always of equal size, and are called the "regular inter-radii," and when they contain plates these are designated the "regular inter-radials." The fifth is larger than either of the other four, and is called the "azygos inter-radius," from the Greek *azugos*, "unyoked," or "not paired." The plates in this inter-radius are called the azygos inter-radials. In most works the "azygos inter-radials" are termed "anal plates," but as they are not anal plates, I think another name preferable. The *azugos inter-radials* always mark the anterior side of the animal or that side towards which the mouth is most approximated. The posterior is directly opposite, and indicated by the azygos ray. There are thus in every Crinoid two pairs of rays, the right and the left, and an odd or azygos ray. There are also two pairs of inter-radii, the right and left pairs, and an odd one, which is the azygos or anterior inter-radius. When a Crinoid is placed with its anterior side towards the observer, the left anterior ray is opposite his right hand and the right anterior ray opposite his left. Such genera as *Glyptocrinus* and *Rhodocrinus* have both regular and azygos inter-radials, but *Palæocrinus*, *Carabocrinus* and others of a similar structure, have only the latter."

VII. *The Mouth, Ambulacral Grooves, and Ambulacral Orifices*

"The space on the upper part of the body surrounded by the arms is called the ventral surface, and, by some authors, the vault. It is covered with plates, which are usually smaller than those of the walls of the cup, and disposed without any observable order. The mouth is a circular or oval aperture, situated either in the centre of the vault or between the centre and the margin of the cup, towards the anterior side or below the margin in the side. It sometimes consists of a tube called the proboscis," which rises from two or three lines to more than an inch above the surface. In some species, such as *Caryocrinus ornatus* (Say), it is closed by a valvular apparatus consisting of five or six small triangular plates. In *Pentacrinus caput-Medusæ* there is a central orifice, and, proceeding from it, five ambulacral grooves on the surface of the vault, which radiate outwards and divide into ten before reaching the margin. The ten grooves proceed straight to the bases of the ten secondary rays or free arms, and are continued upon them to their extremities. The main grooves send out branches to all the divisions of the arms and to each of the pinnulæ. The grooves throughout their whole length are covered over with a soft skin, through which there are numerous minute circular perforations arranged in two rows, one along each side of the groove. These orifices are supposed to be passages for the fluid which serves to extend or retract a set of small sucking feet which are visible on the outside, one over each orifice. The margins of the grooves are bordered by small erect moveable plates, which extend along the sides like a fence of minute palings. These are the *marginal plates* of the *ambulacral grooves*."

"The grooves are covered passages, along which are conveyed from the interior of the body to the arms and pinnulæ a number of tubular vessels whose functions appear to be of great importance in the physiology of the Crinoids. As the eggs from which the young are produced are developed in the pinnulæ, no doubt there must be an organ of some kind connected with their generation which communicates with the viscera of the animal by passing along the grooves. Another set of vessels are the aquiferous canals, consisting of long, slender tubes for the conveyance of the fluid by which the sucking feet of the arms and pinnulæ are extended or retracted. To these must be added the blood-vessels, nervous filaments, and muscles. Traces only of these have been actually observed, but the almost perfect identity in structure be-

tween the ambulacra of the Crinoids and those of the Star-fishes, in which it is well known that such organs do exist, renders it quite certain that the former as well as the latter are provided with a full set of ambulacral vessels."

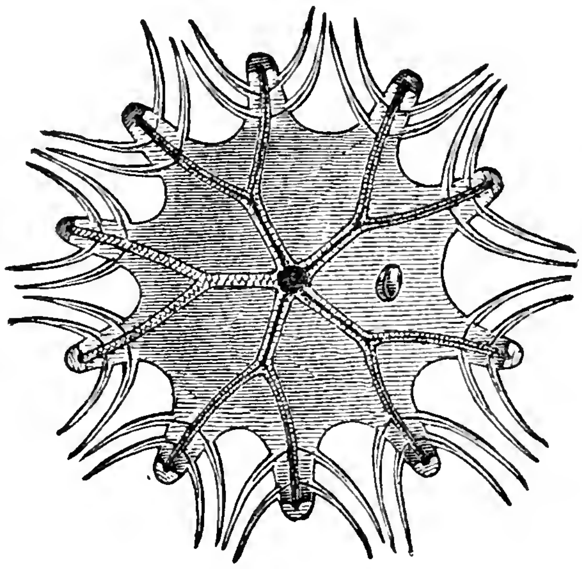

Figure 1.

Figure 1. Diagram of the ventral surface of *Pentacrinus caput-Medusæ*. The central orifice is supposed to be the mouth; the other, the anus. One of the grooves is represented as being closed over by the marginal plates.

"In many of the extinct species of Crinoids, although the arms and pinnulæ are grooved, yet there are no grooves leading from the bases of the arms to the mouth; and it therefore becomes probable that the ambulacral vessels of the arms and pinnulæ do not enter the body through that orifice. Indeed in a great many species, as the mouth is situated in the top of a tube which is sometimes longer than the arms and rises above them, it seems impossible that they could gain access to the interior by that route. Accordingly a more direct passage is provided. In a great many species which have no calycinal grooves there is an aperture at the base of each arm in which the groove of the arm terminates I think that in such species the ambulacral vessels, after descending from the extremity of the arms to the bases of the arms, pass directly into the body through these apertures. I have therefore, in Decade III., proposed to call these the *ambulacral orifices*."

The Decade contains descriptions of many new forms, some of them, as is the case of the remarkable *Blastoidocrinus carchariædens*, worked out for the first time, and in a most able manner, by the author of the Decade. These descriptions it is impos-

sible to condense or analyze; but the work itself is on sale at a price which places it within reach of any one.

The engravings in the first Decade were executed in London. Those in the fourth have been done in a less expensive but equally effective style in Montreal, the drawing on stone being the work of Mr. Smith, an artist attached to the Survey, and the printing by Mr. Matthews.

J. W. D.

REVIEWS.

The Naturalist in Bermuda; a sketch of the Geology, Zoology, and Botany of that remarkable group of Islands, together with meteorological observations. By I. M. Jones, Esq., middle temple, assisted by Major J. W. Wedderburn, and J. L. Hurdis, Esq. With a map and illustrations; London, Reeves & Trubner. Montreal: B. Dawson & Son pp. 200.

This is a very creditable production considering that it has been written by one whose residence on the islands was but brief. The author has been largely indebted for many facts and incidents to amateur Naturalists, whose local knowledge and observation are both accurate and extensive. The book gives a brief account of the Geology of these curious islands abridged from the first paper ever published on the subject, by Col. Nelson, R. E., and printed in the transactions of the Geological Society of London. Probably not much more than what is contained in that paper, can be said of the calcareous rocks of which these islands are composed. A more minute examination would, however, we believe lead to interesting conclusions, as to the physical changes of which they have been the theatre. The whole group is made up of curiously formed croralline arenaceous rocks, some parts of which are of a finer grain and more indurated than others, they are in fact, just a series of petrified sand hills. The most interesting part of this book is that in the department of Ornithology. It occupies about a third part of the volume, and contains a pretty accurate enumeration of the species to be found from time to time on the islands; several valuable notices are given concerning the migrations of the migratory birds. Very few birds are permanent residents in the Bermudas, but immense numbers are known at particular seasons, to rest there as they pass to the South and North. Most of these latter are natives of the American Conti-

nent. Only a few European species find their way there, and these evidently driven by stress of weather. One fact new to Zoology which this book contains is the roving or migratory habit of the Genus *Vespertilio*, two species have been found though rarely upon the island, (*V. Pruinous and V. Noctivagans*) and neither are known to be residents or to breed there. They would thus appear to have much greater powers of sustained flight than are generally supposed. These notes would have been more valuable for scientific purposes had they contained a good classification of the species so arranged as to indicate the permanent and the migratory species, and those which visit the islands on both their southern and northern migrations or on either only. A very limited account is given of the fish tribe. The most noticeable are described, and the popular names of others given. We are not aware that any of the fish caught in these waters are peculiar to them. They may all we believe, be found either on the American coast or in the West Indian Archipelago. A most interesting monogram might be written on this department alone. The Zoology of the waters, while by far the most interesting, is but slightly treated of in this book. A few notices are given of the Crustaceans and the Molluscs, and these by no means very scientific in their character, but nothing at all is said of the innumerable Medusae which infest the waters, of the Echini and Asterias, to be found in all the sheltered bays and creeks; of the Actiniae with which the rocks are every where brilliantly adorned; of the polypi, the great builders of the islands and the manufacturers of its beautiful corals; of the Bryozoa of which there are many fine species. Neither is any notice whatever taken of the magnificent marine botany which is so remarkable a feature of the natural history of these Islands. Much therefore remains to be done ere the "still vex't Bermoothes" can be said to have their own monograph. What this book contains is an important and interesting item of their natural history not by any means to be despised. Its author is remembered by the Mudians as an earnest and enterprising entomologist, and during his brief stay is known to have made the best use of his time. In the department of Botany the names and characters of the most valuable plants and trees are given, but much remains to be done. A small *hortus siccus* in the public library of Bermuda would have furnished the author with several species not named in this book. Another edition is however promised, and communications are invited relating to

the Natural History of the islands. If such is ever published, the defects we have noted may be remedied, and adequate justice done to the flora and fauna of these beautiful islands, which are in truth a very paradise of Natural History. As a contribution to science containing much that is original and interesting, we cordially recommend this little book to our readers. A. F. K.

The Microscope: being a Popular Description of the Most Instructive and Beautiful Objects for Exhibition. By L. Lane Clarke. London, G. Routledge & Co.; Montreal, B. Dawson & Son. pp. 231.

This is a most useful book as an accompaniment to the microscope and the object-box. Its object is to give simply that knowledge of vegetable and animal physiology which will enable the young student to understand the nature of the prepared objects, and excite the desire to learn more from better books. It is in fact an index and descriptive catalogue of the numerous animal and vegetable organisms whose beautiful structures have been unfolded by skillful preparation under the microscope. Now that so much interest is taken in microscopic studies, and that good instruments are becoming common ornaments of the drawing-room and useful companions in the study, a book such as this becomes necessary for intelligent and profitable observations. The first part treats in a familiar and popular way of the use of the microscope, and gives good practical directions for the mounting and preparing of objects. The other parts treat successively, and with great accuracy, of objects from the vegetable kingdom which comprise a wide range of vegetable physiology,—objects from the animal kingdom in which much that is interesting in the structures of insects and zoophytes is described and noted. The book concludes with a good index, and with a pretty extensive catalogue of microscopic objects prepared and sold by Charles Baker, optician, London. While this book belongs more to the department of manufacture than of science, it yet embraces much that is of scientific interest and value. For amateurs and the young it will be found most suitable. Among the number of introductory and popular books now issuing from the press of Europe and America on the subject of the microscope, this may be numbered as one worthy of commendation, and may safely be recommended to the attention of our readers. A. F. K.

Curiosities of Natural History. By FRANCIS T. BUCKLAND, M.A. From the fourth London edition. New York, Reid & Carleton; Montreal, B. Dawson.

This book is written by a son of the late celebrated Dr. Buckland. It is of a most miscellaneous order. The most of it was written for popular London periodicals and partakes of the lively style peculiar to such writing. It makes no pretensions to a scientific treatment of its topics. It aims, if we may so speak, at something higher than this,—at exhibiting the life of certain curious and well-known animals. The author has been a keen observer of the habits of animals, and has taken note of many striking features in their habits which came under his notice. He has in this way made a really delightful gossiping book, full of humour and anecdote, and very accurate in its illustrations, analogies, and anecdotes. The four chapters treat of frogs, rats, serpents, fish, and monkeys,—a sufficiently miscellaneous and odd group of creatures. Besides his own observations, the writer has gathered together numerous curious incidents and anecdotes from the writings of others, illustrative of the habits and instincts of these animals. This is an illustration of how much interest and amusement may be derived from the study of natural history. It makes evident the fact that we do not need to travel far for objects of interest. There is no living creature a minute knowledge of whose peculiarities would not be interesting were they accurately observed and noted. We can recommend this book as containing a most lively, humorous, and instructive account of the peculiarities, affections, and instincts of an interesting circle of animals.

MISCELLANEOUS.

A List of Birds found in Upper Canada. By T. COTTLE, Esq., Woodstock, C. W.

This list cannot be considered perfect, being only such as have come under my own observation, and is, I am aware, most deficient in the small warblers and sparrows:—

1. Buteo Borealis.
2. B. lineatus.
3. Aquila chrysætos.
4. Haliætus leucocephalus.
5. Pandion Haliætus.
6. *Falco Sparverius.
7. Accipiter palumbarius.
8. A. Cooperi.
9. A. Pensylvanicus.
10. Surnia funerea.

* F. Peregrinus and F. Columbarius, I believe, are also found, but have not come under my own observation.

11. S. nyctea.
12. Ulula Acadica.
13. Syrnium cinereum.
14. S. nebulosum.
15. Otu vulgaris.
16. Bubo Virginianus.
17. B. Asio.
18. Caprimulgus vociferus.
19. C. Virginianus.
20. Chætura pelasgia.
21. Hirundo purpurea.
22. H. viridis.
23. H. fulva.
24. H. rufa.
25. H. riparia.
26. Tyrannus intrepidus.
27. T. crinitus.
28. Tyrannula fusca.
29. T. virens.
30. Muscicapa ruticilla.
31. Sylvicola coronata.
32. S. icterocephala.
33. S. Blackburniæ.
34. S. æstiva.
35. Trichas Philadelphia.
36. Certhia familiaris.
37. Parus atricapillus.
38. Regulus Satrapa.
39. R. Calendula.
40. Sialia Wilsonii.
41. Orpheus felivox.
42. O. rufus.
43. Turdus migratorius.
44. T. solitarius.
45. Seiurus aurocapillus.
46. Alauda alpestris.
47. Plectrophanes nivalis.
48. Emberizia socialis.
49. E. Canadensis.
50. Fringilla nivalis.
51. F. melodia.
52. F. Pennsylvanica.
53. F. leucophrys.
54. Spiza cyanea.
55. Linaria minor.
56. Carduelis tristis.
57. C. pinus.
58. Pipilo erythropthalmus.
59. Erythrospiza purpurea.
60. Corythus Enucleator.
61. Guiraca Ludoviciana.
62. Coccothraustes vespertina.
63. Pyranga rubra.
64. Dolichonyx orizivora.
65. Molothrus pecoris.
66. Agelaius phœniceus.
67. Icterus Baltimore.
68. Quiscalus versicolor.
69. Sturnella ludoviciana.
70. Corvus corax.
71. C. Americanus.
72. Garrulus cristatus.
73. Lanius borealis.
74. L. ludovicianus.
75. Vireo olivaceus.
76. Bombycilla garrula.
77. B. Carolinensis.
78. Sitta Carolinensis.
79. S. Canadensis.
80. Trochilus colubris.
81. Alcedo Alcyon.
82. Picus pileatus.
83. Dendrocopus villosus.
84. D. pubescens.
85. D. varius.
*86. D. meridionalis (?) Linn.
†87. Apternus Arcticus.
88. Melanerpes erythrocephalus.
89. Colaptes Carolinus.
90. Co. auratus.
91. Coccyzus Americanus.
92. C. erythrophalmus.
93. Ectopistes migratoria.
94. E. Carolinensis.
95. Meleagris Gallopavo.
96. Ortyx Virginiana.
97. Bonasia umbellus.
‡98. Tetrao cupido.
99. Fulica Americana.
100. Gallinula chloropus
101. Crex Carolinus.
§102. C. Jamaicensis.
103. Rallus crepitans.
104. R. Virginianus.
105. Grus Canadensis.
106. Charadrius vociferus
107. C. Wilsonius.
108. Tringa arenaria.
109. Totanus macularius.
110. T. vociferus.
‖111. Limosa Hudsonica.
112. Scolopax Wilsonii

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* In 1854 I procured a bird which I believe to be this bird, as described by Swainson in a note on Fauna Bor. Amer.

† One specimen only seen in the woods, but not procured.

‡ On the authority of an inn-keeper at Chatham, who asserted that they were occasionally seen in that neighbourhood.

§ A specimen in the collection of W. Poole. Esq.

‖ I have only seen one specimen, which was killed at Long Point on Lake Erie, and is in my possession.

113. S. minor vel Americana.
114. Ardea Herodias.
115. Botaurus lentiginosa.
116. Ardeola exilis.
117. Anser Canadensis.
118. Anas Boschas.
119. A. obscura.
120. A. Americana.
121. A. acuta.
122. A. Americana.
123. A. sponsa.
124. A. Carolinensis.
125. A. discors.
126. A. clypeata.
127. Fuligula ferina.
128. F. valisneriana.
129. F. marila.
130. F. rubida.
131. F. clangula.
132. F. albeola.
133. F. glacialis.
134. Mergus merganser.
135. M. serrator.
136. M. cucullatus.
137. Sterna nigra.
138. Larus Bonapartii.
139. L. occidentalis.
¶140. L. argentatus.
141. Colymbus glacialis.
142. Podiceps cornutus.

Species observed since the above list was prepared:—

Tyrranula Acadica.
Fuligula rufitorques.
Colymbus septentrionalis.
Podiceps Caroliniensis.

NATURAL HISTORY SOCIETY.

Report of the Council for the year 1858.

The revolving year having again brought round the period for the annual meeting of this Society, your Council have, in accordance with custom and constitutional requirements, to report:

That, during the past year, the Building in Little St. James Street, occupied and owned for so many years by the Society, has been sold, and the proceeds applied towards the erection of a more suitable edifice, on ground acquired on advantageous terms from the Governors of McGill College. The new building is situated in the most rapidly increasing part of the city, and contains an extensive *Museum*, *Lecture Room*, *Library and Keeper's apartments*.

By the Report of the Curator and Librarian, it will be seen that the specimens and books were removed to the new building in February last, and that, on the 23rd of that month, it was formally opened to the public by a *conversazione*, at which many of our most distinguished citizens were present. The specimens have since been more perfectly arranged, and are now undergoing cleansing and repairing by the Cabinet-keeper, Mr. Hunter. Owing to the increased accommodation which the Museum affords, your Council recommend that steps be taken for increasing the contributions to it. Similar Societies ought to be communicated with, respecting an interchange of duplicate speci-

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¶ A specimen in immature plumage, in my collection.

mens, of which there is a large number in your collection, and corresponding and ordinary members be advised that donations will be acceptable and publicly acknowledged. Among the additions now being made to the Museum, your Council deem the *Aquarian* and *Microscopic departments* deserving of special notice.

By the Treasurer's Report, it appears that the cost of the new building has been $10,553·75 ; and that the debt still due upon it is about $3,600, of which $2,400 is secured by mortgage, and the balance, $1,200, including some accounts not yet settled, exists as a floating debt.

The assistance and countenance afforded to similar institutions by European Governments, led your Council to believe that, in a new country like this, the natural resources of which require to be developed, and the tone and character of its society formed, the Legislature, to whom an application was made, would cheerfully have aided the efforts of your society in effecting these desirable ends. But such has not been the case, and, therefore, your Council, impressed with the belief that the pursuits of the natural sciences and literature are not yet fully appreciated here, take this occasion of directing public attention to the pleasure, instruction and recreation to be derived from them.

Whoever has experienced the harass and fatigue of spirit arising from close application of the mental powers for any lengthened time to one absorbing and anxious object, must have felt the craving of the mind for some new occupation which, by a healthful change, might relieve the fatigue and weariness of the over-wrought and over-exerted mental organs. This relief is not always to be obtained by absolute rest. The mere cessation of exertion does not satisfy to fell the void created by long and tiring labor on an exclusive subject. Again, when from illness, misfortune, or any other cause, the laborious man of business, or the diligent student, is incapacitated for his accustomed pursuits, how depressing is the langour which attends him in his retirement, unless he has some intellectual resources on which to exercise his otherwise inert and useless powers! Accustomed to other exertions in his ordinary avocations, if he be deprived of these, and no substitute presents itself to take their place, the mind will become wearied and depressed from the very absence of healthy exercise and employment. And if still farther, through success in his avocation, the approach of age finds him retiring from his wonted stirring occupation, and hoping, after a life spent

in the exercise of active duties, to enjoy the blessings of a competency in that rest from labor, which to a mind well regulated and stored with intellectual resources, constitutes the height of earthly enjoyment, and a precious auxiliary means of preparation for the great change to which he is hastening; and if there be no store of intellectual treasure—no pursuit in science or literature to occupy the leisure days and years that remain to him, how listless, at the best, and how full of misery is the interval allotted to him between the cessation of his active employment and the end of his earthly career! These considerations show how important it is to provide a rational and intellectual amusement and relaxation in the intervals of business—in the time of illness or misfortune, and in retirement after the ordinary duties and avocations of life are over.

Of the desireableness of such a provision we have unhappily but too many proofs, in the sad and even fatal results of its neglect. The instances are not few, in which persons suddenly deprived of fortune fly to the stimulus of drink to drown their misery, or become the prey of incurable dejection;—nor of those who retire from business with a competency, hoping to enjoy the remainder of their days in comfort and pleasure, but finding themselves disappointed, become equally afflicted with the *tedium vitre.* On the other hand many examples might be quoted to show how possible it is, without in any way interfering with the ordinary duties of life, to acquire such a knowledge of science or literature as will prove a healthful recreation, not only to the individual but to those around him. Of all the studies calculated to effect that purpose, perhaps that of the natural sciences, and especially of those, usually designated by the term of Natural History, have the highest claim on a community like ours. The animal and vegetable kingdoms, the rocks and the mountains, are open to the investigation of all. The fields and the forest—the lake and the river, as well as the atmosphere we breathe, teem with myriads of beings, the study of whose beautiful forms, structures, functions, habits, modes of formation and distribution is full of interest and instruction, and clearly indicate the endless design and boundless power of the Creator. The Animalcule, whose dwelling is the leaf of a plant, is as perfect in its organization as the most gigantic monster that ploughs the deep or roams the forest. The histology of the most tiny plant is equally complicated with that of the aged oak. Of no less interest is the study of

the rocks that constitute the crust of our earth. The study of both the organic and inorganic kingdoms is indeed a never failing source of instruction and rational amusement in times of leisure, depression or real sorrow.

The Course of Lectures annually delivered under the auspices of the Society commenced on the 1st day of March and were well attended by the public.

The Introductory Lecture was delivered by the President,—Principal Dawson.

2 Lecture—Tuesday, 8th March—By Rev. Dr. De Sola. Subject: "Scripture Zoology."

3 Lecture—Tuesday, 15th March—By W. H. Hingston, M.D. Subject: "Climate of Canada."

4 Lecture—Tuesday, 22nd March—By Rev. A. F. Kemp. Subject: "Fresh Water Algae."

5 Lecture—Tuesday, 29th March—By Professor S. P. Robins. Subject: "Force."

6 Lecture—Tuesday, 5th April—By the Lord Bishop. Subject: "State and prospects of Science and Literature in Montreal."

The Council feel deeply indebted to these gentlemen for their valuable services, and congratulate the Society on the growing interest taken in the lectures by the public, as evinced by the large attendances. They have also much pleasure in referring to the unusually interesting papers which have been read at the ordinary monthly meetings.

The Council have likewise to make special mention of the services of Dr. Fenwick, the Curator and Librarian, in superintending the removal and arrangement of the Library and Museum, and of the exertions of by the Recording Secretary, Mr. John Leeming, and the Treasurer, Mr. James Ferrier, jr., more especially in the erection of the new building

The Council report with pleasure that, during this session of Parliament, the Society has been able to secure such amendments in its charter of incorporation as have long been desired, and which will enable it to act with freedom and energy in carrying out its legitimate purposes; and the thanks of this Society are due to C. Dunkin, Esq., M.P.P., for his very able and disinterested action in this matter, and in superintending the progress of the Bill through Parliament.

The Council have resolved that the By-Laws, with as correct a list as can be made out of Honorary and Corresponding Members, shall be published with the Annual Report

Finally, the Council, in resigning their charge, beg to express their sanguine expectations respecting the future progress and usefulness of your Society as a scientific and literary institution. They feel assured, that its utility and position only require to be properly explained to this liberal and enterprising community in order to obtain that support which it really requires and undoubtedly deserves.

REPORT OF THE LIBRARY COMMITTEE.

We beg to submit for your consideration the Annual Report on the Library and Museum. The Librarian reports, that in the month of August last, he inspected the journals, transactions of societies, and other loose papers, the property of this Society, and on the occasion of the August meeting, submitted for consideration a hastily drawn up report of the many missing numbers of periodicals, and also recommended that all periodicals and papers worth preserving should be bound at the termination of each year.

It is actually necessary that the by-laws regarding the removal of books be strictly enforced. Members have hitherto been in the habit of taking books from the library, and retaining them in their possession for months, if not years, and, as a consequence, many works of great value have been lost.

Early in February, the library and museum were removed to this building. During this removal, Mr. D'Urbain, the sub-curator, rendered efficient service, and in the subsequent arrangement of the specimens and library, much assistance was rendered by our President, Principal Dawson, Mr. D'Urbain, and other gentlemen, who gave considerable time towards that desired end.

Since the occupancy of this building, the Society have secured the valuable services of Mr. William Hunter, who has, since his appointment, opened all the cases of birds and animals, thoroughly cleansed the specimens, and re-arranged many of them. He has also set up between 90 and 100 new specimens which have been added to our collection.

The Curator further draws attention to the many duplicate specimens of birds, both American and foreign, fossils, minerals, &c., which, by judicious exchange, would secure many objects which are not in our collection.

The accommodation afforded in the spacious hall of this building is, for the present, more than sufficient, there being room for a much larger collection than we at present possess.

It is to be hoped that members interested in the welfare of this Society will not neglect any opportunity of sending specimens for preservation, so as to render, as far as possible, the collection in the various branches of Natural History complete.

These views would be more fully carried out were the members of this Society to form themselves into sub-branches, each being devoted to some special department of Natural History. This would tend to augment our collection and increase the usefulness of the Society as a whole.

REPORT OF THE EDITING COMMITTEE.

The third volume (1858) of "The Canadian Naturalist; and proceedings of the Natural History Society of Montreal," the editing of which was entrusted to this Committee, has been completed. It has been published in numbers every two month's with much regularity. It contains twenty-five original articles, presented to the Society by its members or correspondents, and prepared expressly for the magazine. These articles, for the most part, pertain to scientific affairs within the Province of Canada, and embrace original investigations and discoveries in the departments of Geology, Zoology, and Botany. Thirteen articles on topics of interest to the Science of this country have been selected from the valuab'e reports of the Geological survey of Canada, and from the Scientific Journals of Britain and the United States. The chief scientific books which have been published during the year have been either reviewed or noticed, and described with discrimination and care. Numerous scientific gleanings and communications have also been published, which, though not ranking as articles, were yet in great part original. The volume is illustrated with two steel engravings and many original wood cuts of much interest and virtue. For the engravings the editors are indebted to the geological survey, and they desire to acknowledge with thanks, the valuable assistance they have ever received from Sir Wm. E. Logan and his staff.

The number of copies published of each issue is eight hundred and fifty. Free copies are sent to most of the Scientific Societies of Europe and America, for which several exchanges are received and will be acknowledged in their proper place. The editors would, however note, that the number of copies published is greater than the number of subscribers, and therefore urge upon the members and friends of the Society to do what they can to

extend the circulation of the magazine. It is quite indispensible to the promotion of science in this province, and its discontinuance would be felt as a great loss and discouragement. The Society is much indebted to our excellent publishers, Messrs. B. Dawson & Son, for the uniform liberality with which they have provided for the printing and illustrating of the magazine. The editors are also happy to say that the publishers intimate their present determination to undertake all the risks of publication, so long as the Society will provide the editors and contribute the articles.

The first two numbers of vol. iv. have been issued, and the third number is in course of preparation. The editors cannot conclude this report without thanking the contributors for their past services, and expressing a hope that the interest and excellence of the magazine will be sustained in the year to come, and will meet with increased encouragement from the educated people of this province.

PARTICULARS OF COST OF NEW BUILDING IN UNIVERSITY STREET.

Carpenter Work,	$4300 00
Stone and Brick Work,	2700 00
Bricks,	742 70
Plastering,	585 90
Painting,	508 07
Iron Pillars, Castings, and Iron Pipes,	519 00
Gas and Water Fixtures,	400 00
Excavating,	203 73
Piling,	85 60
Seats,	210 00
Stoves and Fixtures,	57 33
Labor, watching, and sundry small accounts,	241 42
Superintendent's commission,	235 00
Fuel,	208 45
	$10997 20

Montreal, 2nd May, 1859.

The contributions to the Museum and Library will appear in our next issue.

THE NATURAL HISTORY SOCIETY OF MONTREAL IN ACCOUNT WITH JAMES FERRIER, JR., TREASURER.

RECAPITULATION.

Dr.		Cr.	
May 2, 1859.		May 2, 1859.	
To cash paid salaries,	$204 20	By balance in Treasurer's hands,	172 87
" commissions,	30 00	" cash received from L'Institut Canadien Francais, on account of building in Little St. James street,	2000 00
" fuel,	56 40	" cash received from William Nivin, sale of mortgage on building in Little St. James street,	2400 00
" gas and water,	78 15	" cash received from Trustees Cunynghame, sale of balance of mortgage on building in Little St. James street,	3600 00
" interest,	616 00	" cash received from Local Committee, American Association, on account,	800 00
" express charges,	8 79	" do. William Niven, on mortgage of new building in University street,	2000 00
" advertising and printing,	113 83	" cash, life-member subscription, new building,	1620 00
" insurance,	58 00	" cash donations to ditto,	60 00
" notarial expenses,	47 00	" cash subscriptions and diplomas,	491 00
" incidental "	53 73	" balance due Treasurer,	719 43
" Mrs. Blythe's mortgage on building in Little St. James Street,	1600 00		
" in erection of new building in University Street, as per statement,	10997 20		
	$13863 30		$13863 30

E. and O. excepted.

JAMES FERRIER, Jr.,
Treasurer.

Montreal, 2nd May, 1859.

Examined and found correct.

W. H. A. DAVIES,
HENRY ROSE, } *Committee of Audit.*

May 17, 1859.

MONTHLY METEOROLOGICAL REGISTER, ST. MARTINS, ISLE JESUS, CANADA EAST, (NINE MILES WEST OF MONTREAL,) FOR THE MONTH OF DECEMBER, 1858.

Latitude, 45 degrees 32 minutes North. Longitude, 73 degrees 36 minutes West. Height above the level of the Sea, 118 feet.

BY CHARLES SMALLWOOD, M.D., LL.D.

Day of Month	Barometer, corrected and reduced to 32° F. (English inches)			Temperature of the Air. F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Mean Velocity in Miles per hour.			Amo'nt of Rain in inches.	Amo'nt of Snow in inches.	Weather, Clouds, Remarks, &c., &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 a. m.	10 p. m.			6 a. m.	2 p. m.	10 p. m.
1	30 304	30 301	30 355	−1 0	16 8	4 2	034	053	038	84	53	73	W. N. W.	S. W.	S. E.	22 24	5 21	0 30			Clear.	Clear.	Clear. Aurora Borealis
2	064	29 908	29 906	7 9	18 1	20 1	048	072	091	77	75	88	N. E. by E	N. E. by E	E. by N.	5 02	3 92	1 05		Inapp.	Slight snow.	C. Str. 6.	C. Str. 10.
3	29 852	694	967	19 5	28 0	10 9	097	135	054	92	88	78	W.	N. E. by E	W. N. W.	0 22	1 10	12 81		1 10	C. Str. 9.	Snow.	Clear
4	30 152	30 049	30 098	−5 0	13 0	11 1	029	054	057	82	71	79	S. E. by E	N. E. by E	N. E. by E.	0 86	0 35	4 27		0 96	" 6.	C. Str. 10.	Snow.
5	29 941	29 692	29 574	8 0	18 0	23 0	054	088	120	88	92	84	N. E.	N. E. by E	W. N. W.	13 87	12 57	8 30			" 10.	Sleet.	Rain.
6	760	950	30 125	30 0	22 0	18 3	148	084	079	89	71	78	W.	N. E. by E	N. N. W.	2 62	24 03	14 51	8 970		" 6.	C. Str. 8.	Clear.
7	30 104	911	29 700	5 7	22 1	33 0	049	090	168	84	78	80	E. N. E.	E. N. E.	S. S. E.	0 20	8 62	6 37			Hoar frost.	" 8.	Snow.
8	29 601	600	724	32 0	30 2	21 0	162	142	096	89	84	85	W.	W. by S	W	18 76	10 68	5 46		0 52	C. Str. 10.	" 2.	C. Str. 10.
9	946	30 027	30 181	7 2	13 1	1 0	019	068	040	81	81	80	W.	W.	W. by S.	29 81	14 51	10 56			Clear.	Clear.	Clear.
10	30 271	171	29 914	5 1	17 6	20 1	022	072	091	68	76	85	S. W.	S. S. E.	S. by E.	3 81	0 74	3 22		0 10	C. Str. 10.	C. Str. 10.	C. Str. 10
11	29 901	29 960	30 174	19 1	22 0	7 2	087	101	042	81	86	70	W.	W. N. W.	W. N. W.	9 20	14 08	9 60			" 4.	Clear.	Clear. F't Aurora Bor'lis.
12	30 245	30 449	405	−7 5	11 0	5 2	025	042	046	80	55	87	S. by E.	E. by S.	E. by S.	0 12	0 01	0 16			Clear.	C. Str. 6.	Cirr. 4. Imperfect Halo.
13	091	29 800	29 816	6 6	33 0	31 4	049	175	190	88	96	95	N. E. by E	S. S. E.	S. S. E.	1 22	15 48	9 02	Inapp	0 70	Snow.	Rain.	C. Str. 10.
14	29 800	510	520	30 0	36 7	34 2	154	177	182	96	89	95	N. E.	S. W.	S. S. E.	0 00	0 11	0 75	0 012		C. Str. 10.	C. Str. 4.	Rain.
15	497	520	720	34 0	36 1	08 6	182	191	129	96	90	82	N. W. by W.	S. W.	W.	0 93	0 06	7 73	0 178		Rain.	" 9.	Clear.
16	861	854	900	21 4	38 1	26 5	096	139	117	85	90	82	W. S. W.	W. S. W.	N. E. by E.	7 56	3 32	14 32		0 04	Clear.	C. Str. 2.	Snow.
17	30 150	30 142	30 268	4 1	21 0	1 2	058	089	034	78	71	71	N. E. by E	N. E. by E	E. by N.	15 32	3 52	3 30			"	" 10.	Hazy.
18	380	381	415	−6 0	5 2	−6 5	021	029	026	80	55	80	N. N. E.	S	S.	9 63	0 60	0 20			"	Clear.	Clear.
19	414	29 964	29 797	−10 7	1 9	8 0	021	040	054	77	88	88	E. by N.	N. E. by E.	N. E. by E.	3 22	9 76	8 70			C. Str. 10.	Snow.	Snow.
20	29 794	842	961	12 0	32 2	12 2	066	143	066	90	79	89	W. S. W.	S. W. by W.	S. W.	1 63	2 45	13 72		1 30	" 4.	[illegible]	Clear.
21	733	460	351	10 4	15 2	17 6	059	076	088	89	82	92	N. E. by E	N. E. by E.	N. E. by E	0 63	1 11	18 37		5 40	" 10.	Snow.	Snow.
22	307	476	864	20 0	21 8	5 6	097	090	055	92	78	61	W. N. W.	W. by N.	W. N. W.	18 37	20 54	21 31		1 10	" 9.	C. Str. 9.	C. Str. 9.
23	910	874	30 004	−2 5	5 8	1 5	032	035	040	83	61	85	W. S. W.	S. E.	S. E.	10 55	0 01	0 01			" 6.	" 9	C. Str. 6. [Bor.
24	30 070	30 214	428	−8 9	12 4	4 0	024	031	031	73	69	80	W. S. W.	W. S. W	S. W. by S.	0 03	0 00	0 00			Cirr. Cum. 4.	Clear.	Clear. Zodiac Light. Aur.
25	518	540	545	−11 2	12 1	−9 7	018	051	022	74	70	76	S. S. W.	S. S. W.	W. S. W.	0 00	0 03	0 01			Clear.	Clear.	Do. do. do.
26	205	29 945	29 817	−10 2	13 0	10 6	022	039	052	78	60	89	N. E. by E	E. N. E.	E. by S.	0 00	0 00	0 00			"	Clear.	C. Str. 10.
27	29 684	700	859	10 1	29 2	21 7	054	128	090	78	77	78	S. by E.	W. N. W.	W. by N.	4 30	7 02	5 83			Snow.	C. Str. 8.	Clear.
28	979	30 049	30 061	10 0	13 7	4 0	057	059	058	79	72	76	W. N. W.	W. N. W.	W.	12 97	12 90	4 41		1 01	Clear.	Clear.	"
29	30 078	090	237	−12 0	11 0	−15 2	020	042	104	76	59	69	E.	S. by E.	E.	0 11	1 56	0 02			"	Clear.	Clear. Aurora Borealis.
30	528	290	211	−17 6	1 8	2 3	014	034	042	70	72	82	E. by N.	E. by N.	W.	14 10	11 43	15 62			"	Clear.	C. Str. 10.
31	29 967	29 680	29 647	18 5	31 0	30 1	094	155	148	92	90	89	E. S. E.	S. S. E.	S. by W.	19 00	15 79	13 22	0 016	2 46	C. Str. 10.	Sleet	" 10.

REPORT FOR THE MONTH OF JANUARY, 1859.

Day	Barometer 6 a. m.	2 p. m.	10 p. m.	Temp. 6 a. m.	2 p. m.	10 p. m.	Tension 6 a. m.	2 p. m.	10 p. m.	Humidity 6 a. m.	2 p. m.	10 p. m.	Wind 6 a. m.	2 p. m.	10 p. m.	Velocity 6 a. m.	2 p. m.	10 p. m.	Rain	Snow	Weather 6 a. m.	2 p. m.	10 p. m.
1	29 662	29 714	29 931	32 0	33 0	21 7	162	216	090	89	91	78	W. S. W.	W. S. W.	N. W. by N	2 41	5 23	19 90			C. Str. 8.	C. Str. 6.	Clear.
2	30 169	30 225	30 374	7 1	21 6	−0 4	045	086	036	76	71	82	N. N. W.	S. S. W.	E. S. E.	13 40	0 72	1 04			Str. 8.	Clear.	"
3	416	260	267	−3 6	11 9	4 1	031	051	036	83	70	72	N. E. by E.	N. E. by E	N. E. by E.	6 71	8 62	7 18			C. Str. 10.	"	"
4	041	29 942	29 614	8 9	24 1	22 4	051	112	101	77	85	86	N. E. by E.	N. E. by E.	N. E. by E.	10 21	3 54	0 76		0 06	" 10.	"	C. Str. 10.
5	29 621	670	691	26 1	33 2	35 4	117	204	170	82	86	82	N. E. by E.	S. by E.	S. by E.	1 22	1 08	2 12			" 10.	C. Str. 4.	" 6.
6	870	30 089	30 094	32 0	32 1	18 0	168	162	077	89	84	76	S. W.	W. by N.	W. by N.	23 32	8 60	9 77			" 10.	" 4.	" 10.
7	977	29 916	29 471	17 1	36 7	21 7	072	191	090	75	90	78	N. E. by E.	N. E. by E	W. by N.	11 22	1 46	0 61	0 021	2 16	Snow.	Snow.	Sleet Rain.
8	576	734	859	−4 1	1 9	−13 6	031	034	018	83	84	74	W. by S.	W. by S.	W. by N.	36 02	13 26	18 33			C. Str. 10.	C. Str. 4.	Clear.
9	30 139	30 228	30 180	−29 9	−21 5	−32 1	008	010	003	60	63	58	E. N. E.	N. E. by E.	W. S. W.	14 77	8 98	3 03			Str. 2.	Clear.	" Aurora Borealis.
10	614	520	522	−15 6	−11 3	−29 2	000	017	006	47	73	52	W. S. W.	S. W. by S.	S. W. by S.	0 20	0 01	0 05			Clear.	"	" "
11	425	328	523	−37 1	−19 9	−21 6	001	012	011	58	67	64	E. N. E.	N. E. by E.	S. by W.	0 13	0 01	0 02			"	C. Str. 9.	" "
12	066	29 976	29 925	18 4	−10 4	−5 0	077	021	022	57	70	70	N. E. by E	N. E. by E.	N. E. by E.	21 61	14 45	11 70			"	Snow.	Snow.
13	29 731	831	30 000	−5 1	12 2	10 8	025	060	048	46	80	69	N. E. by E.	S. by W.	E. by N.	9 62	0 75	0 48		3 16	C. Str. 10.	C. Str. 10.	C. Str. 10.
14	871	757	29 632	8 5	15 6	17 8	059	070	088	88	80	92	N. E. by E.	N. E. by E.	N. E. by E.	10 86	10 01	14 00		1 10	Snow.	" 10.	Snow.
15	526	127	239	19 7	25 5	21 3	096	155	100	90	96	96	N. E. by E.	N. E. by E.	N. E. by E.	20 27	0 06	7 77	Inapp	2 30		Rain.	Sleet.
16	574	746	979	16 1	19 0	11 3	070	077	076	84	76	91	W. S. W.	W. S. W.	S.	19 95	8 22	10 81		0 24	C. Str. 10.	Snow.	C. Str. 10.
17	856	967	30 157	12 9	16 8	01 0	063	058	038	82	75	85	N. E. by E.	N. E. by E.	N. W. by W.	8 00	12 05	1 55		0 47	Snow.	C. Str. 10.	Clear.
18	30 514	30 214	137	10 6	15 0	13 5	021	070	072	77	82	91	N. N. W.	S. by W.	S. by W.	0 05	7 73	2 77		Inapp.	Clear.	" 8.	C. Str. 10.
19	018	020	068	12 5	24 2	19 2	069	094	087	90	73	84	S. E. by E.	N. E. by E.	N. E. by E.	1 02	0 00	1 75		Inapp	Slight snow.	" 8.	" 8.
20	29 925	29 837	29 614	10 6	34 4	32 7	059	160	156	88	84	85	N. E. by E.	S. by E.	S. by E.	0 57	0 01	6 22			Clear.	Clear.	" 6.
21	597	579	724	30 0	38 8	34 2	197	201	169	95	84	85	S. W. by S.	S. W.	S. W.	7 01	5 43	8 67	0 210		Rain.	C. Str. 9	" 10.
22	824	825	30 085	18 0	18 2	5 0	082	089	041	84	80	74	E. by W.	W.	W. N. W.	9 06	0 35	15 81		Inapp.	Snow.	Snow.	Clear.
23	30 230	30 270	529	−4 1	8 9	7 4	031	048	054	83	77	87	S. by W.	S. by E.	S.	9 52	0 00	0 92			Clear.	Clear.	"
24	267	271	227	6 4	27 6	17 9	046	129	072	80	88	85	S. by E.	S. E. by S.	S. by E.	1 47	11 16	0 59			C. Str. 6.	Cirr. 2.	" Zod. Light, bright.
25	261	161	107	10 9	29 0	24 5	060	136	111	80	83	80	N. by W.	S. E.	S. by E.	0 81	0 11	0 20			" 2.	Hazy.	" " "
26	080	078	037	25 1	33 1	33 2	106	180	156	80	77	85	S. S. W	S. W. by S.	S. W. by S.	1 20	5 05	15 03			" 4.	C. C. Str. 6.	C. Str. 10.
27	247	312	350	10 5	20 1	10 1	062	075	084	89	70	79	E. S. E.	N. E. by E.	N. E. by E.	8 52	6 20	2 00			Clear.	C. Str. 6.	Snow.
28	29 868	29 762	29 848	11 0	19 0	20 0	057	087	091	79	84	85	N. E. by E.	N. E. by E.	N. E. by E.	30 05	17 00	12 20	Inapp	7 30	Snow.	Rain.	C. Str. 10.
29	886	900	921	19 4	27 4	24 2	087	141	094	86	98	73	E.	S. by W.	S. S. W.	4 92	0 00	0 20			C. Str. 10.	C. Str. 6.	" 10.
30	978	30 034	30 208	16 2	20 2	13 9	072	080	018	82	75	81	W	W	S. W	17 63	13 30	8 86			Clear.	Cirr. 4.	Clear. Zodiacal Light.
31	30 520	198	220	−3 9	25 7	8 0	051	111	018	83	80	79	S. E. by E.	S. S. E.	S. S. E.	1 06	0 00	0 40			"	Clear.	"

REMARKS FOR DECEMBER, 1858.

Barometer: Highest, the 25th day 30·518 inches. Lowest, " 22nd " 29·307 ". Monthly Mean, 30.015 inches. Monthly Range, 1.241 ".

Thermometer: Highest, the 15th day, 36°4. Lowest, the 30th day, —17°9. Monthly Mean, 12°57. Monthly Range, 54°3.

Greatest intensity of the Sun's rays, 40°4.
Lowest point of terrestrial radiation, 17°9.
Mean of humidity, .787.
Rain fell on 5 days, amounting to 1.176 inches; it was raining 39 hours and 15 minutes.

Snow fell on 12 days, amounting to 16.10 inches; it was snowing 70 hours 10 minutes.
Most prevalent wind, N. E. by E.
Least prevalent wind, E.
Most windy day, the 9th day; mean miles per hour, 18.59.
Least windy day, the 24th day; mean miles per hour, 0.00.
Aurora Borealis visible on 4 nights.
Imperfect lunar halo visible on 1 night
Zodiacal Light visible.
The Electrical state of the atmosphere has indicated light tension.
Ozone was present in rather large quantity.

REMARKS FOR JANUARY, 1859.

Barometer: Highest, the 10th day, 30·614 inches. Lowest, " 15th " 29·127 ". Monthly Mean, 30.021 inches. Monthly Range, 1·477 ".

Thermometer: Highest, the 26th day, 39°4. Lowest, " 10th " —43°6. Monthly Mean, 10°9. Monthly Range, 83°0.

Greatest intensity of the Sun's rays, 40°0.
Lowest point of terrestrial radiation, 43°6.
Mean of humidity, 792.
Rain fell on 4 days, amounting to 0.231 inches; it was raining 21 hours and 38 minutes.

Snow fell on 10 days, amounting to 15·13 inches; it was snowing 67 hours and 5 minutes.
Most prevalent wind, N. E. by E.
Least prevalent wind, E.
Most windy day, the 8th day; mean miles per hour, 22·73.
Least windy day, the 10th day; mean miles per hour, 0·08.
Aurora Borealis visible on 3 nights.
Zodiacal light visible.
The Electrical state of the atmosphere has indicated high tension.
Ozone was present in large quantity.

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THE NATURAL HISTORY SOCIETY OF MONTREAL IN ACCOUNT WITH JAMES FERRIER, JR., TREASURER

MONTHLY METEOROLOGICAL REGISTER, ST. MARTINS, ISLE JESUS, CANADA EAST, (NINE MILES WEST OF MONTREAL,) FOR THE MONTH OF FEBRUARY, 1859.

Latitude, 45 degrees 32 minutes North. Longitude, 73 degrees 36 minutes West. Height above the level of the Sea, 118 feet.

BY CHARLES SMALLWOOD, M.D., LL.D.

Day of Month	Barometer, corrected and reduced to 32° F. (English inches.) 6 a.m.	2 p.m.	10 p.m.	Temperature of the Air. F. 6 a.m.	2 p.m.	10 p.m.	Tension of Aqueous Vapour. 6 a.m.	2 p.m.	10 p.m.	Humidity of the Atmosphere. 6 a.m.	2 p.m.	10 p.m.
1	30.023	30.020	30.091	8.2	20.9	10.2	.048	.088	.041	77	67	78
2	.080	.006	.029	−8.3	10.0	−4.3	.021	.054	.024	62	78	65
3	29.825	29.719	29.606	−4.1	13.6	9.0	.027	.093	.057	70	81	88
4	.491	.577	.780	8.9	26.2	20.1	.057	.117	.191	89	82	85
5	.908	30.025	30.2[illegible]	10.8	19.8	16.3	.048	.081	.073	70	77	84
6	30.088	.054	.092	15.0	18.9	6.1	.071	.077	.049	84	76	87
7	.174	.234	.202	−7.1	20.3	1.0	.042	.065	.031	76	62	71
8	.076	29.950	29.987	−4.2	20.9	25.0	.029	.085	.105	80	78	86
9	29.651	.501	.500	21.1	37.8	31.2	.100	.196	.161	78	86	95
10	.773	.779	30.016	1.0	6.9	−6.1	.014	.015	.028	71	68	80
11	30.113	30.400	.21[illegible]	−18.7	11.6	0.5	.01[illegible]	.057	[illegible]	60	72	81
12	.127	.025	.161	−10.6	25.0	−5.5	.015	.105	.031	58	75	80
13	.131	.000	29.891	−23.2	22.2	9.1	.010	.054	.051	59	71	75
14	29.874	29.767	.874	10.0	23.1	14.7	.054	.123	.067	78	77	81
15	.776	.629	.511	15.2	22.2	21.2	.065	.095	.115	71	79	88
16	.670	.737	.071	32.4	39.8	24.1	.150	.188	.105	84	77	80
17	29.151	30.140	30.025	15.4	38.5	39.9	.067	.150	.091	81	79	85
18	29.811	29.791	29.917	30.4	45.0	37.0	.118	.237	.201	89	87	86
19	.934	.827	.661	17.6	41.9	38.1	.078	.203	.208	83	80	90
20	.178	28.872	.010	35.7	1[illegible].0	32.3	.182	.251	.1[illegible]6	90	95	89
21	.417	29.471	.731	10.3	15.0	14.0	.0[illegible]9	.055	.067	57	61	81
22	.815	.861	.894	15.5	21.4	12.6	.072	.085	.057	91	78	74
23	.878	.797	.781	8.9	27.0	28.0	.051	.117	.107	77	82	80
24	.764	.850	30.246	18.1	27.0	30.1	.100	.111	.057	74	75	79
25	30.[illegible]45	30.260	.277	−6.7	11.1	4.7	.021	.055	.043	62	72	75
26	.090	29.703	29.621	−6.6	11.0	21.8	.021	.062	.101	61	85	86
27	.773	.615	.557	10.4	30.0	30.1	.048	.216	.148	69	91	89
28	.500	.697	.724	27.6	28.0	16.1	.125	.117	.065	82	56	74

Day of Month	Direction of Wind. 6 a.m.	2 p.m.	10 p.m.	Mean Velocity in Miles per hour. 6 a.m.	2 p.m.	10 p.m.	Amo'nt of Rain in inches.	Amo'nt of Snow in inches.	Weather, Clouds, Remarks, &c., &c. [A cloudy sky is represented by 10, a cloudless one by 0.] 6 a.m.	2 p.m.	10 p.m.
1	S. W.	N. by E.	N. by E.	0.15	0.22	0.78		Inapp.	Snow.	C. Str. 6	Clear. Faint Aurora Borealis.
2	N. by E.	N. by E.	N. E.	2.98	1.33	9.81			Clear.	Clear.	Clear. Zodiac Light, very bright
3	N. E. by E.	N. E. by E.	N. E. by E.	21.27	19.26	20.20		1.30	Snow.	Snow.	Snow.
4	N. E. by E.	W. S. W.	S. by W.	20.20	2.28	0.21		3.00	"	C. Str. 6	C. Str. 10.
5	W. S. W.	S. W.	W. S. W.	1.85	3.64	2.82			Clear.	" 2.	" 10.
6	N. E. by E	N. E. by E	N. W. by N	0.86	6.52	0.12		1.72	Snow	Snow.	Clear. Aurora Borealis.
7	W	S. by E.	E.	0.00	0.00	0.00			Clear.	Clear.	Clear.
8	N. E. by E	N. E. by E	S. E. by S.	2.77	0.11	0.03			"	C. Str. 6	Clear.
9	S. by E.	S. E. by S.	W. by S.	0.36	0.00	0.00		3.04	C. Str. 10.	Snow.	C. Str. 10.
10	W. N. W.	W. S. W.	S. W.	13.16	4.57	7.71			Clear.	Clear.	Clear.
11	S. S. W.	S. S. W.	S. W.	0.01	0.01	0.01			"	Clear.	Cirr. 10. Lunar Halo
12	S. W.	S. S. W.	E.	0.00	0.00	0.00			Str. 2.	Clear.	Clear.
13	S. S. W.	S.	S. by E.	0.00	0.00	0.13			Clear.	Clear	Light Cirri. Lunar Halo.
14	S. W.	W. by N.	S. S. W.	3.97	11.10	2.00			C. Str. 10	Clear.	Str. 4.
15	N. E. by E	N. E. by E	E.	0.11	0.16	0.21		0.49	" 9.	Snow.	C. Str. 10.
16	W. S. W.	W. S. W.	W.	3.07	3.08	8.25			" 9	C. Str 8	Clear
17	E. by N.	N. E. by E	N. E. by E.	0.00	0.00	1.56			Clear	" 6	C. Str. 4.
18	S. S. E.	S. W. by W	S. S. W.	13.76	2.61	2.47		1.50	Snow.	" 8.	" 4.
19	S.	N. E.	E. S. E.	0.66	0.76	5.10			Clear	Cirr. Str 3.	" 10.
20	S. E. by E	S. S. W.	W. S. W.	7.83	6.52	20.70	0.512	Inapp.	Rain, with thunder.	Rain	Clear.
21	W. by S.	W. S. W.	W.	12.90	20.47	21.06			C. Str. 8.	C. Str. 9.	C. Str. 6.
22	S. W.	S. W.	E. N. E.	20.21	2.66	9.65			Clear.	Clear	Clear. Aurora Borealis.
23	N. E. by E	N. E. by E.	S. S. E.	1.22	1.16	0.00			C. Str. 3.	C. Str 10	C. Str. 10.
24	W. by S.	N. N. W.	N. N. W.	0.65	5.47	14.[illegible]3			" 5.	" 8.	Clear. Aur. Borealis. Zod. Light
25	N. N. E.	E.	N. E.	9.05	4.62	1.08			Clear.	Clear.	Do. do. do.
26	N. N. E.	N. E. by E.	S. S. E.	12.70	13.57	16.75		8.60	"	Snow.	C. Str. 10.
27	S. S. E.	S. S. E.	S. W.	2.86	1.73	0.15			"	C. Str. 9	Snow.
28	W. by S.	W.	W. by N.	0.28	15.15	9.72		1.10	Snow.	" 9.	C. Str. 9.

REPORT FOR THE MONTH OF MARCH, 1859.

Day	Barometer 6 a.m.	2 p.m.	10 p.m.	Temperature 6 a.m.	2 p.m.	10 p.m.	Tension 6 a.m.	2 p.m.	10 p.m.	Humidity 6 a.m.	2 p.m.	10 p.m.
1	30.161	30.165	30.[illegible]	−7.8	7.9	0.8	.020	.031	.036	70	51	84
2	.192	.422	.414	−18.7	23.0	0.0	.017	.089	.036	69	72	84
3	.2[illegible]1	29.951	29.772	−10.6	17.1	21.9	.021	.0[illegible]8	.102	77	75	92
4	29.561	.250	.318	21.7	33.0	29.6	.090	.168	.151	78	89	94
5	.354	.118	.677	26.2	30.6	31.5	.125	.188	.169	87	77	84
6	.950	30.102	30.114	30.6	35.1	33.0	.112	.177	.1[illegible]6	84	85	85
7	30.047	29.942	29.975	27.9	38.6	19.0	.123	.186	.087	82	81	81
8	29.550	.500	.669	15.7	31.5	21.2	.077	.149	.105	76	84	80
9	.780	.874	.970	12.4	32.9	23.1	.1[illegible]1	.215	.113	71	79	85
10	30.033	.921	30.065	11.2	19.1	26.7	.057	.200	.117	79	82	82
11	.014	29.972	29.812	21.1	16.5	38.1	.090	.251	.203	7[illegible]	81	91
12	29.687	.742	.804	34.7	37.5	31.6	.225	.233	.228	91	89	87
13	.860	.991	30.119	34.7	47.0	36.6	.181	.233	.184	84	85	87
14	30.152	.291	29.879	21.2	44.5	39.7	.109	.231	.210	83	80	86
15	29.478	.439	.470	38.2	46.0	37.0	.211	.218	.199	87	85	90
16	.690	.819	.930	32.0	36.1	31.1	.149	.170	.162	81	80	84
17	.929	.967	.911	29.4	48.3	37.4	.136	.255	.104	83	81	86
18	.650	.294	.127	30.4	41.7	37.7	.184	.258	.198	85	85	86
19	28.620	28.635	.078	42.6	46.1	22.5	.158	.256	.0[illegible]4	87	92	71
20	29.317	29.528	.779	19.8	27.2	26.3	.087	.111	.117	81	75	82
21	.924	.942	.908	19.7	40.1	30.1	.081	.203	.112	77	82	81
22	.907	.850	.700	25.5	51.2	30.1	.111	.155	.148	81	78	89
23	.752	.798	.816	28.2	44.0	35.5	.129	.211	.170	81	83	80
24	.771	.567	.516	26.7	31.4	38.7	.123	.169	.223	87	84	95
25	.437	.421	.547	31.0	52.1	30.6	.182	.270	.191	95	72	83
26	.630	.544	.621	33.2	37.0	32.0	.168	.178	.162	89	81	89
27	.524	.567	.661	25.2	38.2	32.5	.105	.18[illegible]	.149	80	84	84
28	.751	.671	.690	27.1	40.9	31.5	.125	.175	.155	82	69	79
29	.597	.200	.114	34.2	50.1	40.2	.162	.204	.219	84	85	87
30	.550	.407	.550	35.1	40.0	34.1	.146	.167	.155	85	68	79
31	.534	.514	.760	30.1	38.5	29.6	.150	.180	.136	78	77	84

Day	Wind 6 a.m.	2 p.m.	10 p.m.	Velocity 6 a.m.	2 p.m.	10 p.m.	Rain	Snow	Weather 6 a.m.	2 p.m.	10 p.m.
1	W. by S.	W.	S. W. by W.	10.90	11.55	1.22			Clear.	Clear.	Clear. Aurora Borealis.
2	S. S. W.	S.		19.20	0.56	2.[illegible]2			"	Clear.	" "
3	N. E.	N. E. by E.	S. E.	0.[illegible]1	7.57	11.[illegible]7			"	C. Str. 10	Snow
4	E. S. E.	S. S. E.	N. E. by E.	17.70	5.32	1.75		5.50	Snow.	Snow.	C. Str. 10.
5	N. E. by E.	E. S. E.	W. by S.	11.93	6.51	12.16		Inapp.	C. Str. 10	C. Str. 10.	" 10.
6	W.	W.	W. S. W.	10.98	5.10	8.08			" 9.	" 8	" 10.
7	N. E. by E.	N. E. by E.	N. E.	7.60	3.52	3.10			Str. 2	Clear.	" 8.
8	N. E. by E	N. E.	N. E.	23.21	21.9[illegible]	12.82			C. Str. 10.	C. Str 8.	Clear. Aurora Borealis.
9	W. by S.	S. W. by S.	S. W. by W.	5.47	2.16	0.[illegible]1			Clear.	Clear.	Clear.
10	S. by W.	N. E. by S.	S. E.	0.41	0.57	0.27			"	"	Cirri Cumulus 4.
11	N. N. E.	N. E. by E.	S. E. by S.	4.30	7.73	10.06			"	"	C. Str. 10.
12	S. E. by S.	S.	S. S. W.	19.75	14.10	4.76	0.262		Rain.	C. Str. 10.	" 8.
13		W. S. W.	W. S. W.	15.12	14.26	3.80			C. Str. 4	Str 2.	" 8.
14	E. by S.	N. E. by E.	N. E. by E.	0.50	3.20	5.73			" 4	C. Str. 6	" 10.
15	S. E.	S. E. by S.	N. E. by E.	1.00	9.60	5.10	0.250		Rain	C. Str 10.	" 9.
16	W. S. W.	W. by S.	S. W.	2.22	20.38	29.45			C. C. Str. 9.	" 4	Clear
17	S. S. W.	S. E. by S.	S. E. by S.	5.76	0.77	0.01			Clear.	C. C. Str. 8.	C. Str. 10.
18	E.	N. E. by E.	N. E.	2.34	5.81	5.37	0.217		C. Str. 10.	Rain.	" 10.
19	S. W.	S. by E.	W. by S.	11.07	6.78	19.72	0.316		Rain.	C. Str. 8	" 8.
20	W. by N.	W. by N.	W. by N.	29.98	32.22	16.00			C. Str. 8.	" 9	Clear.
21	W. by N.	S. W.	S. S. E.	20.20	11.00	8.57			Clear.	Cirr. Str. 2	Clear. Aurora Borealis.
22	N. E. by E	N. E. by E.	N. E. by E.	2.16	10.23	10.1		2.90	Str. 4	Snow.	C. Str. 10.
23	S. W. by W	W. S. W.	S. W.	4.16	5.47	2.28			C. Str. 10	C. Str. 4.	Clear.
24	N. E. by E	E. N. E.	E. N. E.	3.22	6.62	8.47	0.410		" 10.	Rain.	C. Str. 9.
25	N. E. by E.	S. W. by W.	S. by W.	18.33	3.51	2.43	0.250		Rain.	C. Str. 4.	" 9.
26	S. W. by W.	S. W. by W.	S. W. by W	1.46	7.65	2.22		Inapp.	C. Str. 8.	" 6	" 4.
27	S. W.	W. by S.	S. W.	24.22	0.37	12.59			Clear.	Cirr. 5.	Clear. Aurora Borealis.
28	E. N. E.	N. E. by E.	N. E. by E.	0.46	1.08	9.76			Clear.	C. Str. 6.	Clear.
29	N. E. by E.	S. E.	S. W.	8.54	2.73	13.80	0.570		C. Str. 8	Rain.	C. Str. 9.
30	W. by S.	W. S. W.	W. S. W.	22.80	18.41	11.63			" 8	C. Str. 2.	Str. 2.
31	W. S. W.	W.	W.	9.57	16.02	20.11	Inapp.		" 1.	" 8.	Clear. Faint Aurora Borealis.

REMARKS FOR FEBRUARY, 1859.

Barometer — Highest, the 11th day, 30.460 inches. Lowest, " 20th " 28.872 ". Monthly Mean, 29.857 inches. Monthly Range, 1.578 ".

Thermometer — Highest, the 20th day, 43°.1. Lowest, the 13th day, −25°.6. Monthly Mean, 15°.62. Monthly Range, 68°.7.

Greatest intensity of the Sun's rays, 58°.7.

Lowest point of terrestrial radiation, 23°.9.

Mean of humidity, .776.

Rain fell on 2 days, amounting to 0.512 inches, it was raining 9 hours 15 minutes, and was accompanied by thunder on 1 day.

Snow fell on 10 days, amounting to 23.55 inches; it was snowing 93 hours 45 minutes.

Most prevalent wind, N. E. by E.

Least prevalent wind, N.

Most windy day, the 21st day; mean miles per hour, 28.14.

Least windy day, the 12th day; mean miles per hour, 0.00.

Aurora Borealis visible on 5 nights.

Zodiacal Light visible.

Lunar Halo visible on 2 nights.

The Electrical state of the atmosphere has indicated moderate intensity.

Ozone was present in moderate quantity.

REMARKS FOR MARCH, 1859.

Barometer. — Highest, the 2nd day, 30.492 inches. Lowest, " 19th " 28.620 ". Monthly Mean, 29.686 inches. Monthly Range, 1.872 ".

Thermometer. — Highest, the 24th day, 47°.5. Lowest, " 3rd " −11°.6. Monthly Mean, 30°.93. Monthly Range, 5[illegible]°.1.

Greatest intensity of the Sun's rays, 77°.6.

Lowest point of terrestrial radiation, 11°.9.

Mean of humidity, .823.

Rain fell on 8 days, amounting to 2.195 inches; it was raining 59 hours and 30 minutes.

Snow fell on 4 days, amounting to 8.40 inches; it was snowing 11 hours and 45 minutes.

Most prevalent wind, N. E. by E.

Least prevalent wind, E.

Most windy day, the 20th day; mean miles per hour, 26.26.

Least windy day, the 10th day; mean miles per hour, 0.32.

Aurora Borealis visible on 7 nights.

A splendid Meteor in N. N. W. at 8.30 p.m., 28th day.

The Electrical state of the atmosphere has indicated very high tension.

Ozone was present in large quantity.

Picus villosus, woodpecker, seen on the 1st day.

Corvus corone, crows, first seen on the 8th day.

Fringilla melodia, song-sparrow, first seen on the 14th day.

Anser Canadensis, wild ducks (flying south), first seen on the 18th day.

THE

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ARTICLE XVIII.—*On the Natural History of the Gulf of St. Lawrence.* By ROBERT BELL, jr.

(Continued from our last Number.)

RADIATA.

Ophiocoma bellis.—Abundant at Ste. Anne adhering to the roots of *Agarum Turneri.**

Astrophyton scutotum.—This beautiful species does not seem to be very rare in the Gulf. I was informed by a person at Green Island, who possessed a specimen, that about a dozen of them were found clinging to a chain which had been submerged for some time, at a short distance from the island. A fine specimen from the Gulf in the collection of the Survey is about 16 inches in diameter, and I saw a fresh specimen in the hands of some fishermen who had, however, already disposed of it, which was nearly as large.

Cribella oculata.—Near Ste. Anne, I found two fine specimens of this species which had just been thrown up by the waves.

Solaster papposa.—Rather small specimens dredged at Marcouin in about 30 fathoms.

* An Alga with large perforated fronds.

Uraster, ——— ?—The species described by Principal Dawson on page 159 of this volume, and which may be *Asteracanthion Forbesi*, is by far the most abundant starfish on our coast. This is a well marked species and its characters are very constant. Amongst multitudes of them, I have never seen one which had either fewer or more than six rays, although an occasional individual was otherwise deformed. When alive their colour is deep purple above and light straw-colour beneath.

U. rubens.—Very abundant near low tide at Les Islets.

Echinarchinus Atlanticus.—Very abundant on smooth or muddy bottoms along the whole coast, from Rimouski downwards, and often found in stomachs of cod and haddock.

Echinus granularis.—Extremely abundant along the whole coast.

Cucumaria corumarius.—Sea Cucumbers, which seem to be identical with this species, were found alive very frequently at low tide about Ste. Anne, and for some miles farther up the coast; but they may have come from the Laminarian zone, as specimens were afterwards dredged in 12 fathoms at the same place.

Psolus (?)—A species of this genus is abundant in many places on the coast between Metis and St. Clair. When the black skin covering the scaly arrangement is removed, the whole of the body is of a bright vermillion colour. They seem to differ from *P. phantopus* of Linnæus, but may be only a variety of that species.

Montreal, 14th May, 1859.

CATALOGUE OF COLEOPTERA COLLECTED BY MR. ROBERT BELL, 1858.

Cicindela longilabris, Say.—Green Island Seigniory, between Metis and Lake Matapedia, and Ste. Anne.

" *vulgaris*, Say.—Ste. Anne, Ruisseau de la Grande Vallée, and between Metis and the mouth of the Matapedia.

" *duodecimguttata*, Dej.—Metis River, between Metis and the Matapedia, and Ste. Anne.

" *Baltimorensis*, Herbst. (*repanda*, Say).—Rimouski, Metis River, and Capuchin.

Brachinus, (not determined).—Abundant at Metis River.

Cymindis reflexa, Lec. (*marginata*, Kirby).—Rivière du Loup, Rimouski, Metis, and Matanne.

Calathus gregarius, Say.—St. Simon, from the mouth of the Marcouin to the Shick Shock Mountains, 14 miles up that river, and Mount Commis on the Metis.

Platynus sinuatus, Dej.—Point Levi, St. Simon, and Marcouin River.

" *extensicollis*, Say.—Metis River.

" *melanarius*, Dej.—Point Levi opposite Quebec.

" *tenuis*, Say.—Berthier and Ste. Anne.

" *cupripenne*, Say.—Point Levi, St. Simon, and Ste. Anne.

" *retractus*, Lec.—Berthier, Rivière du Loup, and Ste. Anne.

" *picipennis*, Kirby, (*lenum*, Lec.)—Berthier, Marcouin River, and between Metis and the Matapedia.

" *lutulentus*, Lec.—Point Levi.

" *placidus*, Say.—Berthier, Matanne, and Ruisseau de la Grande Vallée.

Pœcilus lucublandus, Say.—Very abundant at Point Levi, Berthier, Rivière du Loup, Green Island Village, St. Simon and Metis.

Pterostichus erythropus, Dej.—Point Levi.

" *patruelis*, Dej.—Green Island Seigniory.

" *mandibularis*, Kirby.—Between the mouth of the Marcouin and the Shick Shock Mountains.

" *caudicalis*, Say.—Berthier and Green Island Seigniory.

" *corvinus*, Lec.—Point Levi.

" *orinomum*, Leach. (*vitreus*, Esch.)—Abundant from Rivière du Loup to Ste. Anne, and Mount Commis on the Metis.

" *Luczotii*, Dej. (var. præc. ?)—Metis and Ste. Anne.

" *adjunctus*, Lec.—Rivière du Loup to Ste. Anne.

Amara libera, Lec.—Rivière du Loup.

" *pallipes*, Kirby, (*depressa*. Lec.)—Rimouski.

" *impuncticollis*, Say.—Berthier and Ste. Anne.

" *fallax*, Lec.—Green Island Seigniory and Matanne.

" *interstitialis*, Dej.—Rimouski and Matanne.

Anisodactylus Harrisii, Lec. (*agricola*, fide Harris).—Point Levi and Berthier.

Harpalus viridiæneus, Beauv.—Very abundant at Green Island Seigniory, between Metis Lake and the Matapedia, Matanne, and Ste. Anne.

" *pleuriticus*, Kirby.—Abundant from Berthier to Rimouski.

" *megacephalus*, Lec.—Rivière du Loup.

" *rufimanus*, Lec.—St. Anne.

Chlænius sericeus, Say.—Point Levi, Berthier, and St. Simon.

" *chlorophanus*, Dej.—Metis River.

" *tricolor*, Dej.—Berthier.

Cychrus (*Sphæroderus*) *Brevoortii*, Lec.—Rivière du Loup, St. Simon, Mount Commis, 20 miles up Metis River, Ste. Anne, and Marcouin River.

Carabus serratus, Say.—Rivière du Loup to Matanne, and between Metis and the Matapedia River.

" *Lapilayi*, Lec.—Rivière du Loup and Green Island Seigniory.

Calosoma calidum, Fabr.—L'Islet, Rimouski, Metis, Matanne, and Ste. Anne.
Elaphrus californicus, Mann. *var. punctatissimus*, Lec.—St. Simon.
Patrobus longicornis, Say.—Berthier, Metis, and mouth of the Matapedia.
" *angicollis*, Randall.—Metis River.
Bembidium dilatatum, Lec.—Metis River.
" *lucidum*, Lec.—Point Levi.
Dytiscus confluens, Say. (*O. oligbukii*, Kirby.)—Mouth of Metis River.
Agabus striatus (?), Say.—Rivière du Loup, Green Island Seigniory, and Ste. Anne.
Necrophorus velutinus, Fabr.—Metis River.
Silpha lapponica, Herbst.—Very abundant at Ste. Anne.
Staphylinus villosus, Grav.—Rimouski, Metis, Matanne, and Ste. Anne.
Omosita colon, Fab.—In vast numbers in fields manured with Capelin.
Pediacus planus, Lec.—Between Metis and the Matapedia.
Byrrhus picipes, Kirby.—Ste. Anne.
Platycerus depressus, Lec.—Ste. Anne.
Aphodius fossor, ("absolutely the same as the European," Leconte, in lit.) —Rivière du Loup and Ste. Anne.
" *fimetarius*, Fabr.—Abundant from Metis to the Matapedia.
" *N. sp.* (?).—Metis.
Lachnosterna fusca, Fröhlich.—Point Levi and Rivière du Loup.
Dichelonycha subvittata, Lec.—Ste. Anne.
Ancylochira maculiventris, Say.—Metis River, and between Metis and the Matapedia.
Ellychnia corrusca, Dej.—Capuchin, Ste. Anne, and Ruisseau de la Grande Vallée.
Meloe rugipennis, Lec.—Between Metis and the mouth of the Matapedia.
Serropalpus substriatus, Hd.—Metis River.
Upis reticulata, Say.—Metis.
Tomicus (not named).—Between Metis and the Matapedia.
Physocnemum ligneum, Fabr.—Green Island Seigniory.
Monohammus confusor, Kirby.—Metis.
" *scutellatus*, Say.—Metis and Ste. Anne.
Chrysomela scalaris, Lec.—Metis.
Galleruca (not named).—Between Metis and the Matapedia.
Coccinella novemnotata, Fabr.—Rimouski and Metis.

NOTE.—The species in the above catalogue were most kindly determined for me by Dr. J. L. Leconte, and great confidence may therefore be placed in it. A considerable number of species besides the above were also collected by Mr. Bell, but were unfortunately destroyed on the journey to Phildelphia.

W. S. M. D'URBAN.

CATALOGUE OF LEPIDOPTERA COLLECTED BY MR. ROBERT BELL, 1858.

RHOPALOCERA.

Papilio Turnus, Linn.—Extremely abundant at Ste. Anne and along the coast from Cape Chatte to Martin River, from June 18th to the end of July, frequently assembling round muddy places in great numbers.

Colias philodice, Godart.—Abundant at Cape Chatte and Ste. Anne from June 10th to the middle of July. A few were observed between Metis and Lake Matapedia and at Campbellton, at the mouth of the River Ristigouche in August. It was very numerous at the mouth of the Matapedia on 27th August and was last seen on the Ristigouche on 1st September.

Pieris oleracea, Harris.—Observed at St. Simon on May 28th. Common at Ste. Anne from June 20th to the middle of July.

Limenitis arthemis, Drury.—One specimen was taken at Ste. Anne on July 10th, and another was observed on Marcouin River July 26th.

Cynthia cardui, Linn.—Two specimens only were met with ; the first in the Seigniory of Grand Metis, August 16th. and the second near Dalhousie, N. B., August 25th.

Vanessa J. album, Boisduval.—Two specimens taken on the Patapedia River at its junction with the Awaganissis, September 12th.

" *antiopa*, Linn.—One specimen taken at Metis, and another near Rimouski, September 29th. It was not observed elsewhere.

Grapta progne. Fab.—Frequently met with from Rivière du Loup to Ste. Anne from May 18th to July 19th. Very abundant at Lake Matapedia August 17th, and all along the Ristigouche and Patapedia Rivers up to September 12th.

" *C. aureum*, Cramer (?).—One specimen taken at the mouth of the the Awaganissis Brook

Argynnis aphrodite, Fab.—First observed at Ste. Anne on the 20th June, and was very abundant there for the next month. It was also observed at the Marcouin River, between Metis and Lake Matapedia, at the mouth of the Matapedia, on the Ristigouche, and lastly, at the mouth of the Awaganissis September 12th.

" *Myrina*, Cramer.—Not uncommon at Ste. Anne about the end of June and beginning of July. It was also observed between Metis and Lake Matapedia August 16th.

" *Bellona*, Godart.—One specimen at the mouth of the Matapedia River August 27th.

Melitæa Tharos, Cramer.—A few specimens of this species were taken at Ste. Anne at the beginning of July.

Polyommatus pseudargiolus, Boisd.—Numerous at Rivière du Loup May 19th, and from thence to Chatte River June 18th.

Hesperia ———— (?).—Numerous about Metis August 13th, and at Lake Matapedia August 17th.

HETEROCERA.

BOMBYCINA.

Orgyia ————— —Matapedia River August 20th.

Ctenucha Latreillana, Kirby.—In great abundance at Ste. Anne July 20th.

Phragmatobia fuliginosa, Linn.—Matan June 12th, not common.

NOCTUINA.

Mamestra ————.—Ste. Anne.

Plusia ————.—Common in Gaspé and on the Ristigouche.

GEOMETRINA.

Five species of undetermined genera.

PYRALIDINA.

Pyralis (?) ————.—Mouth of the Matapedia River.

Crambus ————.—Very abundant in meadows at Ste. Anne, and at the mouth of the Matapedia.

CATALOGUE OF PLANTS COLLECTED BY MR. ROBERT BELL, 1858.

Ranunculaceæ.

Anemone Pennsylvanica, Linn. In full flower August 12th, Metis.

Thalictrum Cornuti, Linn. In full flower July 16th, Ste. Anne.

Ranunculus repens, Linn. " " " "

" acris, Linn. " " " "

" (undetermined). No flower, September 1st, River Ristigouche.

Caltha palustris, Linn. In full flower June 5th, Rimouski.

Aquilegia Canadensis, Linn. In full flower May 16th, L'Islet.

Nymphæaceæ.

Nuphar advena, Ait., (a very small form). In full flower August, West end of Lake Metapedia.

Sarraceniaceæ.

Sarracenia purpurea, Linn. In full flower June, Ste. Anne.

Fumariaceæ.

Corydalis aurea, Pursh. In full flower August 30th, Ristigouche River.

Cruciferæ.

Sinapis arvensis, Linn. In full flower July 11th, Ste. Anne.

Violaceæ.

Viola cucullata, Ait. In full flower May 30th, St. Simon.

Cistaceæ.

Hudsonia tomentosa. Nutt. In full flower August 31st, River Ristigouche.

Parnassiaceæ.

Parnassia Carolinianum, Michx. In full flower August 30th.

Caryophyllaceæ.

Silene inflata, Smith. In full flower July 6th, Ste. Anne.

Mœhringia lateriflora, Linn. In full flower July 23rd, Portage between Martin and Marcouin rivers.

Spergula arvensis, (?) Linn. No flower August 12th, Metis.

Oxalidaceæ.

Oxalis acetosella, Linn. Very abundant all up the River Marcouin.

" stricta, Linn. Going to seed August 30th, River Ristigouche.

Anacardiaceæ.

Rhus Toxicodendron, Linn. Fruit ripe August 31st, River Ristigouche.

Sapindaceæ.

Acer spicatum, Linn. Abundant everywhere on low land; just out of flower July 5th, Ste. Anne. In seed Sept. 11th, mouth of the Awaganissis brook.

" saccharinum, Wang., (Hard Maple). On rich soil only.

Leguminosæ.

Trifolium repens, Linn. Abundant round clearings, &c., throughout the district.

Desmodium Canadense, D. C. In full flower August 12th and 31st, River Ristigouche.

Vicia Cracca, Linn. In full flower July 11th, Ste. Anne.

Lathyrus palustris, Linn. In full flower, August 4th, mouth of the Marcouin.

Oxytropus Lamberti, (?) Pursh. In full flower August 31st, River Ristigouche.

Rosaceæ.

Prunus pumila, Linn. Fruit nearly ripe August 31st, River Ristigouche.

" Pennsylvanica, Linn. Abundant throughout the counties of Rimouski and Bonaventure.

" Virginiana, Linn. Fruit ripe Sept. 1st, River Ristigouche.

Agrimonia Eupatoria, Linn. In seed August 21st, Fifteen miles up the River Matapedia.

Potentilla Anserina, Linn. In full flower August 4th, mouth of the River Marcouin.

Fragaria Virginiana, Ehrhart. Grass land throughout the district. Fruit ripe beginning of July, at Ste. Anne.

Rubus triflorus, Rich. Fruit ripe July 12th, Ste. Anne; mouth of the Awaganissis.

" strigosus, Miche. Extremely abundant on burnt land and about fences throughout the district.

Rosa blanda, Ait. In blossom, July 5th and 20th at Ste. Anne, and August 12th at Metis.

Cratægus tomentosa, Linn. River Ristigouche.

Pyrus Americana, D. C. Moderately abundant throughout the district.

Onagraceæ.

Epilobium augustifolium, Linn. In full flower July, 16th Ste. Anne.

" coloratum, Muhl. In seed July, three miles up the River Marcouin.

Œnothera biennis, Linn. In full flower July 11th, Ste. Anne, and August 30th, mouth of the River Matapedia.

Circæa alpina, Linn. In flower July 31st, mouth of the River Marcouin.

Saxifragaceæ.

Mitella nuda, Linn. Seed ripe July, three miles up the River Marcouin.

Umbelliferæ.

Heracleum lanatum, Michx. In full flower July 16th, Ste. Anne.

Sium lineare, Mich. In full flower August 12th, Metis.

Cornaceæ.

Cornus Canadensis, Linn. In full flower July 5th, Ste. Anne.

" stolonifera, Michx. In full flower June, Ste. Anne.

Caprifoliaceæ.

Linnea borealis, Gronov. In full flower June, Ste. Anne, and abundant everywhere.

Lonicera ciliata, Muhl. In fruit July 30th, Marcouin river.

Diervilla trifida, Mænch. In full flower August 30th, River Ristigouche.

Sambucus Canadensis, Linn. Abundant on low land.

Viburnum opulus, Linn. In full flower July 16th, Ste. Anne.

Compositæ.

Eupatorium purpureum, Linn. In full flower Sept. 3rd, mouth of the River Patapedia.

" ageratoides, Linn. In full flower July 31st, mouth of the River Marcouin, and August 30th, River Ristigouche.

Aster miser, Linn., Ait. In full flower August 12th, Metis.

" simplex, (?) Willd. " " " " "

" longifolius, (?) Lam. " " " " "

Diplopappus umbellatus, Torr. and Gr. In full flower June 30th, mouth of the River Matapedia.

Solidago bicolor, Linn. Going out of flower August 30th, River Ristigouche.

" Canadensis, Linn. In full flower August 12th, Metis.

Achillea Millefolium, Linn. In full flower July 11th, St. Anne, and mouth of the Awaganissis, September.

Leucanthemum vulgare, Lam. In full flower July 4th, Ste. Anne, and August 30th, River Ristigouche.

Cirsium Muticum, Michx. In full flower August 30th, mouth of the River Matapedia.

" pumilum (?), Spreng. Out of flower August 30th, River Ristigouche.

Hieracium Canadense, Michx. In full flower August 30th, River Ristigouche.

Nabalus racemosus, Hook. (" variety with truncate and obcordate leaves," G. B.) August 30th, River Ristigouche.

Lobeliaceæ.

Lobelia Kalmii, Linn. In full flower August 30th, River Ristigouche.

Campanulaceæ.

Campanula rotundifolia, Linn. In full flower August 4th, mouth of the River Marcouin, and Aug. 30th River Ristigouche.

Ericaceæ.

*Vaccinium Pennsylvanicum, (?) Lam. In great profusion on hills which have been burnt over.

Chiogenes hispidula, Torr. and Gr. In great abundance throughout the district.

Andromeda polifolia, Linn. In full flower July 16th, Ste. Anne.

Pyrola rotundifolia, Linn. " " " " " "

Plantaginaceæ.

Plantago maritima, Linn. In full flower August 4th, mouth of the River Marcouin.

Primulaceæ.

Primula farinosa, Linn. Abundant all along the southern shore of the Gulf. In full flower end of May and June.

Lentibulaceæ.

Utricularia vulgaris (?) Linn. Metis.

Scrophulariaceæ.

Chelone glabra, Linn. In full flower August 12th, Metis.

Veronica Americana, Schweinitz. Nearly out of flower July 12th, Ste. Anne.

Pedicularis Canadensis, Linn. In full flower August 10th, Matanne.

Labiatæ.

Lycopus Virginicus, Linn., (a very coarse form). In flower August 30th, River Ristigouche.

Brunella vulgaris, Linn. In flower, July 11th. Ste. Anne.

Scutellaria nervosa, Pursh. In flower August 12th, Metis.

Borraginaceæ.

Mertensia maritima, (?) Don. In flower beginning of July, Ste. Anne.

Apocynaceæ.

Apocynum androsæmifolium, Linn. In full flower August, between Metis and Lake Matapedia.

Asclepiadaceæ.

Asclepias Cornuti, Decaisne. Abundant all along the Ristigouche.

Oleaceæ.

Fraxinus sambucifolia, Lam. (Black Ash). In valleys, and along the shores of the Lakes.

Polygonaceæ.

Rumex Acetosella, Linn. Coming into flower July 16th, Ste. Anne.

Urticaceæ.

Ulmus Americana, Linn., (Swamp Elm). Very abundant, and of large size, along the River Ristigouche.

Cupuliferæ.

Corylus rostrata, Ait., (Hazel nut). Marcouin River.

Betulaceæ.

Betula papyracea, Ait., (White Birch). The most abundant deciduous tree throughout the eastern peninsula, and reaching a large size.

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* This Blueberry is very useful to the Micmac Indians, who are said to preserve the fruit in dried cakes for winter use.

Betulaceæ.

Betula excelsa, Ait., (Yellow Birch). Most abundant round Lake Matapedia, and in the valleys of the Rivers Marcouin and Ristigouche; generally associated with Hard Maple on rich soil.

Alnus incana, Willd., (Alder.) Everywhere bordering the streams and rivers, forming dense thickets.

Salicaceæ.

Populus tremuloides, Michx. (Common Poplar). Abundant on high lands.

" balsamifera, Linn. (Balsam Poplar, Balm of Gilead.) Abundant on the borders of rivers and lakes.

(No Willows were collected).

Coniferæ.

Pinus resinosa, Ait., (Red Pine). Abundant, but of small size, along the upper part of the River Patapedia.

" strobus, Linn., (White Pine). Abundant everywhere.

Abies balsamea, Marshall, (Balsam Fir). Very abundant.

" nigra, Poir., (Black Spruce). Principal and in many places the sole tree covering the hilly country of the eastern peninsula.

" Alba, Michx., (White or "Sea Spruce" of the Indians). The commonest tree along the coast and rivers.

Larix Americana, Michx., (Tamarack). Rather scarce, but occurring in every variety of situation throughout the district.

Thuja occidentalis, Linn., (White Cedar). Very abundant in the vallies of all the rivers, reaching a large diameter, but no great height.

Taxus baccata, Linn., var. Canadensis, (Ground Hemlock). Abundant amongst trees on low ground.

Alismaceæ.

Sagittaria variabilis, Engelm. In full flower August 15th, Metis.

Orchidaceæ.

Platanthera flava, Gray. In full flower September 1st, River Ristigouche.

" psycodes, Gray. In full flower August 17th, West end of Lake Matapedia.

Spiranthes decipiens (?) Hooker. Coming into flower July 30th, Marcouin river.

Corallorhiza Macræi, Gray. Going to seed July 31st, Three miles up the River Marcouin.

Iridaceæ.

Iris versicolor, Linn. In full flower July 4th, Ste. Anne.

Sisyrinchium Bermudiana, Linn., (variety mucronatum, Gray). In flower July 16th, Little St. Anne.

Smilaceæ.

Trillium erectum, Linn., (very large). Fruit ripe July 31st, Three miles up the Marcouin river.

Liliaceæ.

Smilacina stellata, Desf. In full flower June, Ste. Anne.

" bifolia, Ker. In seed, but not ripe, July 20th, Marcouin river.

Clintonia borealis, Raf. Throughout the district.

Melanthaceæ.

Streptopus roseus, Michx. In full flower June, Ste. Anne.

Tofielda glutinosa, Willd. Seed ripe August 30th, River Ristigouche.

Cyperaceæ.

Eriophorum vaginatum, Linn. Ste. Anne.

Gramineæ.

Phleum pratense, Linn., (Timothy). Very abundant everywhere.

Calamagrostis Canadensis, Beauv. Shick Shock Mountains.

Elymus Canadensis, Linn. River Ristigouche.

Avena striata, Michx. (Trisetum purpurascens, Torr.) Shick Shock Mountains.

Equisetaceæ.

Equisetum pratense, Ehrh. Metis.

Filices.

Asplenium Felix-fœmina, R. Br. Mouth of the Awaganissis brook.

Aspidium spinulosum, Swartz. " " " "

Osmunda regalis, Linn. Round Metis Lake, &c.

Botrychium Virginicum, Swartz. Fertile fronds ripe July 28th, River Marcouin.

Lycopodiaceæ.

Lycopodium lucidulum, Michx. In fruit Sept. 1st, River Ristigouche.
" dendroideum, Michx. " " " "
" clavatum, Linn., " " " "
" complanatum, Linn. " " " "

Musci.

Polytrichum commune, Linn. Hypnum splendens, Hedw. " Schreberi, Willd. " Crista-Castrensis, L. " reptile, Michx.	Collected on the River Marcouin.

Lichenes.

Peltigera aphthosa (?) Hoffen, infert. Sticta pulmonaria, Ach.	River Marcouin.

NOTE.—In drawing up the above Catalogue of Plants, collected by Mr. Robert Bell, in the counties of Rimouski, Gaspé and Bonaventure, in the eastern peninsula of Lower Canada, I derived much assistance from George Barnston, Esq., of the Hon. Hudson's Bay Company, who obligingly determined for me all those species about which I was in doubt. The list, from unavoidable circumstances, is not so extensive as could be wished, but it will be found to contain some very interesting species.

It is remarkable that no Oak, White Ash, Basswood, Soft Maple, Beech, Butternut, and Hemlock Fir, were observed in this district.

W. S. M. D'URBAN

Montreal, 14th May, 1859.

ARTICLE XIX.—*Observations on the Natural History of the Valley of the River Rouge, and surrounding Townships in the Counties of Argenteuil and Ottawa.* By W. S. M. D'URBAN.

On the 13th May, 1858, I left Montreal for Grenville on the Ottawa, to accompany a Geological Surveying party, under the immediate direction of Sir W. E. Logan, Provincial Geologist, with whom I remained in the field until the middle of October. Having received instructions to collect specimens, and make observations in Natural History, as far as possible without interfering with the primary objects of the expedition, I did so, and the following notes are the results of my labours. They include lists of the *Mammalia*, *Birds*, *Reptiles*, *Fish*, *Insects*, *Mollusks* and *Plants*, observed in the Townships of Grenville, Chatham, Wentworth, Harrington, Montcalm, Arundel, De Salaberry and Grandison, in the County of Argenteuil, and some unsurveyed parts of the County of Ottawa. With the exception of the immediate neighbourhood of the town of Grenville, which stands on the Chazy Limestone, the whole country traversed lies on the Laurentian formation, and these lists, confessedly imperfect, however, from the limited means at my command, may be considered as a fair illustration of the Fauna and Flora, of a part of the Laurentian region of Canada. There is no correct map of the above named Townships yet published, excepting a portion including the first four, which are accurately laid down in the " Plan, showing the distribution of the Crystalline Limestone of the Laurentian series in various townships between Grenville and Rawdon," published in the Report of the Geological Survey for 1853–56, but the general position of the remainder and the course of the Rouge may be seen by consulting the map prepared by Mr. Keefer, C.E., for the " Canada Directory," for 1857–8.

Our route lay, on leaving Grenville, in a north easterly direction through the Townships of Grenville, Harrington and Wentworth, till we reached a fine sheet of water, named, from the number of the islands on it, " Sixteen Island Lake." It is about eighteen miles in a straight line N. 13°E. from Grenville, and lies in the Townships of Wentworth and Montcalm. Here we were camped for several weeks, making numerous excursions through the neighbouring country. About the middle of June we commenced following a chain of

small lakes, which led us in a westerly direction from Balsam or Chain Lake, a mile to the north of Sixteen Island Lake, through the township of Montcalm, to a beautiful piece of water known as Bevin's Lake in direct communication with the Rouge by a stream of considerable size and upwards of two miles in length. At the beginning of July we began the ascent of the river Rouge, thoroughly exploring the country on either side as we ascended, as far as the Messrs. Hamilton Brothers' excellent farm, the first of three, each 25 miles apart, maintained to aid the lumbering operations conducted by the firm on this river. It is situated about fifty miles from the junction of the Rouge with the Ottawa, on a level tract, composed of drift and fluviatile deposits, showing several terraces rising one above the other, marking ancient channels of the river, and the splendid crops and cattle which we saw, bore unequivocal testimony to the fertility of the soil when properly cultivated. Here we camped on the 21st August, having however previously visited it on several occasions. I remained there till the first week in September, when I made an excursion of ten days' duration, to the Trembling Mountain, a fine range upwards of 2,000 feet in height, rising from the shores of a most beautiful Lake nearly seven miles in length, lying partly in the township of Grandison and about five miles from Hamilton's Farm, which is in the County of Ottawa. We were next occupied in the survey of the Lake of Three Mountains in the County of Ottawa, and the long chain of Lakes connected with it, the outlet to which is a narrow creek several miles in length, running into the Rouge about two miles below the farm. This engaged our attention until the 7th October, when we returned to the farm, and on the 11th I descended the Rouge, reaching Grenville the next day, but was employed for a week traversing the country backwards and forwards, between that town and Bevin's Lake, with the baggage of our party. My observations concluded with my return to Montreal on the 19th October.

VERTEBRATA.

MAMMALIA.

The Mammalia of this district are not numerous, the Algonquin or Two Mountain Indians settled on the Rouge having long ago killed or driven away all the larger animals, and the number of Lumbermen and Surveying parties going up and down the river

at different seasons of the year, contribute to render them scarce in its immediate neighbourhood. The following are all the species observed or concerning which I could obtain any information.

1. *Vespertilio subulatus*, Say, (Say's Bat).—One specimen was shot on the 8th August, in the day time, and on the 10th I saw several flying about in the hottest part of the afternoon, over the Rouge, and every now and then dashing into the water. Bats were numerous throughout the district, and as they varied considerably in size there were probably several species, but from the difficulty of obtaining specimens the present is the only one which I could determine. In the township of Harrington, Bats continued abroad at dusk as late as 17th October.

2. *Ursus Americanus*, Pallas, (Black Bear).—Although none were seen by us, Bears appear to be numerous in the district, more especially about the settlements in autumn, when they are very destructive to the settler's crops and pigs, and are occasionally taken in large iron spring-traps. They are rarely seen in the woods during the summer, but are sometimes killed by the Indians when found in their winter retreats. We however frequently met with recent traces of them, such as trees torn by their claws and stripped of the bark all round the trunks, marks of their teeth, fresh dung, &c., in the townships of Wentworth, Montcalm and Arundel, and on the 15th October I saw a settler greasing the axle-trees of his cart with the fat of one which had been killed a few days previously in the township of Chatham. Near Bark Lake in the 5th and 6th Ranges of Arundel, I observed the marks left by a Bear's teeth on the trunk of a cedar full five feet from the ground. The Indians always examine the bite of this animal on a tree, and imagine that if its teeth have penetrated to the wood it will not be killed that year, but should they have merely entered the bark, he will soon meet with his death.

3. *Mustela Martes*, Linn. (Pine Marten).—Does not appear to be very plentiful. I saw but one which had just been trapped October 10th, at Hamilton's Farm.

4. *M. Canadensis*, Schreber (Fisher).—Reported common about Hamilton's Farm, and I saw one which was shot there October 10th. They are caught in fall-traps made by cutting a square hole in the trunk of a hollow cedar, a few feet from the ground, in which the bait (a piece of fish, the head of a partridge, or part of a squirrel) attached to a trigger, supporting the but-end of a

heavy pole, is placed, this animal being so powerful that it easily tears to pieces the log-traps used for the next species.

5. *Putorius Vison*, Gmel (Mink).—Abundant throughout the district. Their "roads" run round the margin of every lake, and the "portage paths" of the Indians generally follow those these little animals form in their constant passage from one lake to another. It is surprising, considering the number of "log-traps" set for them in these paths over the whole country, the facility with which they are caught, and the eagerness with which they are sought after, that any escape. The skins sell for $2 each, and were formerly worth $2.50. The season for trapping them is the end of September and October. The traps are contructed by driving slabs, split out from a cedar tree, or small stakes into the ground in a circle, leaving a narrow entrance on one side, across which a fir-pole heavily weighted is placed, and so arranged as to fall and crush the animal when the bait inside the circle of sticks is disturbed. The top is covered over with a handful of branches, which prevents the Mink from reaching the bait except by the narrow entrance. As soon as taken, an opening having been made near the tail, the skin is stripped off inside out, and stretched till dry, on three splints of cedar-wood cut to fit accurately together on the principle of a boot-tree. When alarmed, this animal takes to the water, swimming and diving with great readiness, though it can continue but a short time under water. The young are born in June.

6. *Mephitis Chinga*, Tiediman, *Americana*, Sabine, (Skunk). Common about the settlements in Grenville, &c.

7. *Lutra Canadensis*, Sabine, (Otter).—Many seen in the lakes throughout the district. Living entirely on fresh fish which its extraordinary powers of diving enable it to obtain with facility, the Otter will not take any bait, but is captured by means of iron spring-traps without teeth, set at the water's edge in spots where it is in the habit of going in and out of the water. These landing places or "Otter-slides" are usually situated where the shore is pretty steep, and the well-beaten track is always very conspicuous. Unless the trap is firmly secured with a chain or very strong cord, this powerful animal frequently carries it off, but is generally soon drowned by it, and sinks to the bottom where it is not easily found. The skins I was informed are sold at from four to six dollars each.

8. *Vulpes fulvus*, Desm. (Red Fox).—None seen, but reported

common. At the Indian Village on the Rouge, 16th Lot, 7th Range, Arundel, several half-grown puppies were pointed out to us as the offspring of a fox and dog. They very much resembled the fox, and were remarkably gentle and docile in manner, being much petted by the kind-hearted Squaws.

9. *Castor fiber*, Linn. (Beaver).—Though ancient dams made by Beavers were frequently met with in the lakes we visited in Wentworth, Montcalm, Arundel, and De Salaberry, they appear to be nearly extinct in those townships. In a small lake near the Lake of Three Mountains, however, we found fresh branches of the yellow birch, the aromatic bark of which constitutes their winter food, showing the marks of their teeth. The Indians reported them as numerous about forty miles above Hamilton's Farm, and had many skins in proof of their assertion. I was informed that the price of these skins was from five to nine shillings per lb.

10. *Fiber Zibethicus*, Cuvier, (Muskrat).—Very numerous throughout the district. Their food consists of the roots of water-plants and the fresh-water mussels (*Unio complanatus* and *Anodonta*), of which they collect large quantities about their holes in clayey banks of the lakes and rivers, where they leave them in the sun till the shell opens, when they can easily extract the animal. At the beginning of October they commence constructing, on some sunken log or in a shallow place a few yards from the shore, their winter-nests, which are composed of the roots of *Equiseti* and other water-plants torn up from the bottom, and placed in a cirular heap, in the centre of which they form a cavity and pass the winter within it in a torpid state. The Indians trap great numbers at the end of September and beginning of October, and the skins turned inside out, are stretched on bent sticks.

11. *Arctomys Monax*, Linn. (Woodchuck).—Said to be common about the clearings in Grenville, and a specimen was given to me which had just been killed in the 6th Range of that township, May 14th.

12. *Tamias Listeri*, Ray, (Chipmunk).—A few only were seen in the woods of Montcalm, and about Hamilton's Farm.

13. *Sciurus Hudsonius*, Pennant, (Red Squirrel).—Very numerous in the woods throughout the district, and sometimes so tame as to run between our legs. The seeds of the white cedar (*Thuja occidentalis*) are its favourite food, and large heaps of the scales, stripped by it from the cones, may be seen in every

cedar-swamp. In September they feed much on the young seeds of the white pine, and it is somewhat amusing to see a Squirrel running up a tree with a green fir-cone as long as its body sticking out of its mouth, as a man would carry a cigar. They not unfrequently take to the water, crossing from one side of the river to the other, and are then easily captured.

14. *Hystrix dorsata*, Linn., *pilosus*, Catesby, (Porcupine).—I observed some bundles of quills of this animal in an Indian canoe coming down the river, so I suppose it occurs in the district, though we saw none.

15 *Lepus sylvaticus*, Bachman, *Americana*, Erxlebein, (Hare) Common in the woods though not often seen. On the 11th October, on our way down the Rouge, one was killed on a sandbank, where it had been surprised by the rapid rise of the river during the night.

16. *Cervus alces*, Linn. (Moose).—Judging from the quantity of dried Moose-meat which the Indians coming down the Rouge had in their possession, this animal must be tolerably numerous above Hamilton's Farm, but none were seen in the district we passed through.

17. *C. Virginianus*, Gmel. (Common Deer).—Tracks frequently met with, and two deer were reported to have been seen near Sixteen Island Lake. The Indians say that this animal is very fond of the leaves of *Kalmia angustifolia*, from eating which they become intoxicated, and are then easily killed.

18. *C. tarandus*, Linn. (Caribou).—One was shot September 1st on Hamilton's Farm, while we were camped there, and was the only one seen by us. I however, observed traces of them on Trembling Mountain, the Gneiss rocks of which are clothed with abundance of its peculiar food, the Reindeer-moss (*Cladonia rangiferine*). The hoofs of this animal are remarkably large and flat, and it is thus enabled to pass easily over the deepest snow.

Besides the animals above enumerated, I may mention the Raccoon, *Procyon lotor*, which was spoken of by the Indians as being found in the district; a Wild Cat, (*Lynx Canadensis*) was supposed to have been heard at night in the township of Montcalm; a Flying Squirrel, (*Pteromys volucella?*) is said to occur, and near the Lake of Three Mountains I had a momentary view of a small *Arvicola* of some species.

AVES.

The following list of Birds is as complete as I could make it, under the circumstances, but doubtless many species are omitted, especially amongst the Warblers, their restlessness and the rapidity of their movements, together with the thickness of the foliage in the woods, rendering it difficult to recognise the species. Several Hawks, which I could not determine, were also seen besides those enumerated.

The migration of the smaller insectivorous birds was very remarkable, and for several days towards the end of May, at Sixteen Island Lake, there were literally thousands of Warblers of several species, on their passage northward, flitting about from tree to tree, and on 28th August at Hamilton's Farm great numbers were again seen on their return South, as is noticed below under the respective species. During the middle of summer, however, but very few Warblers, or indeed birds of any kind were to be seen, and those observed were generally in the neighbourhood of the clearings, perhaps because they were there more easily noticed than in the thick woods. At the beginning of September vast flocks of Ducks were often seen flying high in the air towards the south, but owing to the great depth and the rocky character of most of the lakes, the only species of *Natores*, which were at all numerous on them, were such as feed entirely on fish.

The Nomenclature and Arrangement are in accordance with Audubon's "Synopsis of the Birds of North America."

1. *Buteo* —— ?—A Buzzard of some species was frequently seen throughout the district traversed, often hovering round our camps, attracted by the remains of fish, &c., lying about. As it always kept out of shot I was not able to determine the species.

2. *Pandion Haliœtus*, Linn. (Osprey, or Fish Hawk).—On the 21st May I had the pleasure of visiting Lake St. Jean, a small piece of water upwards of a mile in length, situated in the eighth and ninth Ranges of the township of Montcalm and about one mile S.S.E. of Sixteen Island Lake. Here a pair of Ospreys had for many years held undisputed possession of their nest, which they had built on the summit of a large, dead, and isolated pine-tree, standing a short distance from the water, on a small rocky islet near the middle of the lake, and forming a most conspicuous object. There were no other trees on the island, which however was thickly clothed with tall birch and alder bushes. No better site could have been chosen for their nest, as the wary birds

could command a view from it of the whole lake, and observe the approach of every foe. Late in the evening I endeavoured to obtain the only bird to be seen near the nest, but it was so extremely shy, circling high in the air round the tree far out of shot, that after several ineffectual attempts, I gave it up, till early on the following morning when I again visited the spot. Both birds flew off the nest the moment they perceived my approach in the canoe, and their hurried, startled flight was very peculiar and unlike that of any other hawk I ever saw. Having hid myself in the bushes at the foot of the tree, I sent the canoe with the two men who had brought me there, to the end of the lake, and in a few minutes the male-bird, supposing we had all left the place, returned and pitched on a branch near the top of the pine. I instantly fired one barrel, but although apparently hard struck by the shot which knocked out many of his feathers, he flew off. A moment after the female pitched on the same branch, and having fired my remaining barrel loaded with a heavy charge of duck-shot, she dropped from the giddy height at which she was perched with a leg and wing broken, and otherwise much injured. I rushed to secure her, and though so severely wounded, her splendid golden eye never for an instant quailed, and she fought with desperation, rendering it a difficult matter to despatch her. The male-bird flew up the lake and never returned, and I fear he must have died from the effects of my shot. I had the old pine-tree cut down, as the only means of examining the nest, but was greatly disappointed when I found there were no eggs in it. In this secluded lake, shut in by hills thickly clothed with trees, in the gray of the early morning, rendered still more gloomy by a dense drizzling rain which was falling, it was a splendid sight to see the huge scathed pine plunge into the tranquil water, its rotten branches breaking up into a thousand pieces from the shock, dashing up a cloud of spray, and covering the glassy surface of the lake far around, with its fragments. The nest was very large, composed of sticks of considerable size, and lined with dead leaves. The bird which I shot measured nearly five feet across the extended wings. On dissecting it I found the eggs small (none being larger than a small marble), but numerous. The intestines were about the thickness of a goose-quill, and measured seven feet six inches in length. The heart and liver were very large. The head was so much bigger than the neck I had great difficulty in passing the skin over the skull. There was one small intestinal worm in the stomach.

An Osprey was afterwards seen on several occasions, when ascending the Rouge, wheeling about high in the air, and a large nest probably of this bird, was seen on a dead pine on the shore of Trembling Lake. The numerous lakes full of large trout must afford this species abundance of food.

3. *Falco sparverius*, Linn. (American Sparrow Hawk).—One of this pretty species was observed by me at Sixteen Island Lake. When camped on Hamilton's Farm on the Rouge in August, they were very numerous, generally pitching on the burnt pine-trees round the clearing. They were mostly birds of the season. The stomach of an old male I shot on the 28th August, was filled with Grasshoppers, Black Field-Crickets and Coleoptera, all broken up into small fragments. The last seen by me was on the 7th October.

4. *Astur palumbarius*, Linn. (Goshawk).—Several of this large hawk were observed round the clearings of Hamilton's Farm, at the end of August and beginning of September.

5. *A. fuscus*, Gmel. (Sharp-shinned Hawk).—One specimen was seen near Gate Lake in the 6th Range of Wentworth, May 16th; none were observed again till we reached the large farm where the two last species occurred. This was also very numerous there at the end of August, delighting to pitch on the dead pines which thickly stud some parts of the clearings.

6. *Circus cyaneus*, Linn. (Marsh Harrier).—An immature bird of this species was frequently seen at the end of August and in September, about the clearing just mentioned, which being the only one for 25 miles on either side, offers great attractions for most of the hawks which delight in open places, their usual prey generally inhabiting such situations.

7. *Syrnium nebulosum*, Linn. (Barred Owl).—On the 5th September I observed one of this Owl in the woods not far from Trembling Lake, in the township of Grandison.

8. *Otus brachyotus*, Linn. (Short-eared Owl).—I saw a specimen which had just been shot on the 9th October near the house on Hamilton's Farm. I was informed that this species is not uncommon there in the fields after harvest.

9. *Bubo Virginianus*, Gmel. (Great Horned Owl).—Numerous throughout the district and frequently seen.

10. *Chordeiles Virginianus*, Briss. (Night Hawk).—A single individual was observed by me flying about after dusk on the 21st and 26th August, at Hamilton's Farm.

11. *Chœtura pelasgia*, Linn. (Spine-tailed Swift).—Numerous about Grenville, May 13th, and was rather abundant throughout the district during the summer. The last seen by me was on the 25th August at Hamilton's Farm.

12. *Hirundo purpurea*, Linn. (Purple Martin).—Common at Grenville May 13th, but not afterwards met with.

13. *H. bicolor*, Vieill. (White-bellied Swallow).—Abundant at Grenville May 13th. Large flocks were seen flying over the water at Sixteen Island and St. Jean Lakes, May 18th, 22nd and 24th, apparently on their way northwards. One or two were noticed about the middle of August below Hamilton's Farm but none were seen after 25th August.

14. *H. fulva*, Vieill. (Republican or Cliff-Swallow).—Many were noticed about clearings in the townships of Grenville and Harrington, May 14th and 15th; also at Sixteen Island Lake May 24th. None were met with afterwards till reaching Hamilton's Farm, where the last was seen on 21st. August.

15. *Hirundo rustica*, Linn. (Barn Swallow).—Common about clearings and settlers' houses in the townships of Grenville and Harrington May 14th and 15th. Also about the French Canadian Settlement in Wentworth June 4th. It was very numerous nesting in the barns on Hamilton's Farm July 15th, but they were all gone by the middle of August. This species is never met with except in the immediate vicinity of clearings.

16. *Muscicapa tyrannus*, Linn. (Tyrant Fly-catcher).—Observed near Bevin's Lake and on the Rouge, near the Indian Village, 6th Lot, 7th Range, Arundel Numerous about Hamilton's Farm, 25th August, many of them being young birds.

17. *M. acadica*, Gmel. (Small Green-crested Fly-catcher).—A small Fly-catcher apparently this species was observed by me July 1st, on a clearing near Bevin's Lake, Montcalm, and another at Hamilton's Farm August 25th.

18. *Sylvicola coronata*, Lath. (Yellow-crowned Wood Warbler.)—Very numerous about Sixteen Island and St. Jean Lakes Wentworth, May 19th to 24th, after which I did not again notice it till 28th August when it became very numerous about Hamilton's farm, most of them being young birds. The last seen by me was on September 9th, when camped on an island in Trembling Lake.

19. *S. virens*, Lath. (Black-throated Green Wood Warbler). —In numbers with the preceding and following species about Sixteen Island Lake May 24th, but was not again observed by me.

20. *S. Blackburniæ*, Lath. (Blackburnian Warbler).—This beautiful warbler was numerous about Sixteen Island and St. Jean Lakes, in company with the two foregoing species, May 22nd and 24th. I had great difficulty in obtaining specimens, owing to its extremely active habits. The skin of one shot by myself, has been compared by Dr. Dawson with specimens in his possession from Nova Scotia, with which it perfectly agrees, and there cannot therefore be a doubt about the species, though said to be rare in the States.

21. *S. æstiva*, Gmel. (Yellow-poll Wood Warbler).—Observed in the Township of Grenville May 24th, and a few individuals seen about Hamilton's farm August 23rd and 25th.

22. *S. Canadensis*, Linn. (Black-throated Blue Wood Warbler).—First observed at Hamilton's farm August 28th, and abundant during the first week in September there, and at Trembling Lake. About sunrise on the 23rd September, being camped on the Lake of Three Mountains, and the morning cold and frosty, two of this pretty warbler in company with a Wood Thrush, flitted round our camp-fire as though envying the warmth it afforded us, and this was the last date at which I observed it.

23. *S. maculosa?* Lath. (Black-and-Yellow Warbler).—On the 20th July when at the mouth of the Devil's River, in the first Range of the township of De Salaberry, I observed a warbler which I took to be this species.

24. *Certhia familiaris*, Linn. (Brown Tree-creeper).—When I arrived at Gate Lake in the sixth range of Wentworth, on 17th May, a pair of this bird were building their nest with fragments of decayed wood, moss and spider's webs, behind a piece of bark on a dead tree, about six feet from the ground. It is distributed through the whole district, and on the 28th August at Hamilton's Farm was very numerous, flitting from tree to tree in company with *Sylvicola coronata*, *S. Canadensis*, *Parus atricapillus*, *Regulus satrapa*, and *Sitta Canadensis*, *&c.*, which were then migrating south.

25. *Troglodytes hyemalis*, Vieill. (Winter Wren).—Seen occasionally during the whole summer and up to 26th September, at numerous localities throughout the district.

26. *Parus atricapillus*, Linn. (Black-cap Tit).—None of this species were observed till 17th August, when camped about a mile below Hamilton's Farm, and it was not numerous until the 28th, when great numbers made their appearance, and I occasionally observed them in the woods up to the end of September.

27. *Regulus satrapa*, Lich. (American Golden-crested Kinglet).—First observed on 28th August, on which day great numbers were seen in company with several species of warblers, &c. as before mentioned.

28. *Sialia Wilsoni*, Swains. (Common Blue Bird).—One specimen only observed, 14th October, Township of Grenville.

29. *Turdus migratorius*, Linn. (Robin).—Numerous about all clearings throughout the district up to 15th October. A pair had a nest and young, in a tall Elm at the Indian village, Arundel, July 16.

30. *T. mustilinus*, Gmel. (Wood Thrush).—Not uncommon throughout the district up to the end of September.

31. *Seiurus aurocapillus*, Lath. (Golden-crowned Wood-Wagtail).—Very numerous everywhere throughout the district, especially on the borders of lakes.

32. *Alauda alpestris*, Linn. (Shore Lark).—Large flocks were seen at the end of September feeding on the oat stubble at Hamilton's Farm.

33. *Emberiza socialis*, Wils. (Chipping Bunting).—Numerous at Gate Lake May 16th, and not uncommon about all clearings visited by us up to 18th October.

34. *Niphœa hyemalis*, Linn. (Common Snow-bird).—Numerous about clearings and occasionally observed in the woods throughout the district up to 18th October.

35. *Fringilla melodia*, Wils. (Song Sparrow).—About clearings, but not very numerous, throughout the district. I saw young birds nearly full fledged at Grenville on 5th June.

36. *F. Pennsylvanica*, Lath. (White-throated Sparrow).—Very common in the woods throughout the district. On the 15th of August I found a nest of this species on the ground amongst "Ground Hemlock" or Yew. It was composed of bits of decayed wood, and lined with dry grass. It contained two young birds nearly full fledged, one of which was considerably larger than the other. Large flocks, composed principally of birds of the year, assembled in September about the edges of the fields on Hamilton's Farm, feeding on the scattered oats amongst the stubble, and seeking refuge in the bushes when alarmed. Many were so young they were even then hardly full fledged, and became an easy prey to the numerous hawks about the farm.

37. *Erythrospiza purpurea*, Gmel. (Purple Finch).—Heard singing near Balsam or Chain Lake in the Township of Montcalm,

June 14th. Large flocks seen about Hamilton's Farm July 15th.

38. *Coccoborus ludovicianus*, Linn. (Rose-breasted Grosbeak).—Numerous, feeding amongst wheat stubble on the clearings about Gate Lake, May 16th and 17th.

39. *Agelaius phœniceus*, Linn. (Red-winged Starling).—Common in the Township of Grenville May 13th and 15th. Abundant in marshy places about Sugar-bush and Bevin's Lakes in the Township of Montcalm, June and July. Only one observed near Hamilton's Farm.

40. *Icterus Baltimorus*, Linn. (Baltimore Oriole).—Said to have been heard singing June 14th at Chain Lake Montcalm but not seen

41. *Quiscalus versicolor*, Vieill. (Purple Crow-Blackbird).—Observed at Grenville May 14th, but not afterwards noticed.

42. *Corvus Americanus*, Aud. (Common Crow).—Common throughout the district and in large flocks round Hamilton's Farm.

43. *Garrulus cristatus*, Linn. (Blue Jay).—Abundant everywhere, but extremely numerous round Hamilton's Farm in August, flying about in flocks of thirty or forty, and constantly mobbing the small hawks so numerous at that place.

44. *G. Canadensis*, Linn. (Canada Jay, "Carrion-Bird," "Moose-bird").—Abundant; seen only in the woods in summer, but approaches the settlements in Grenville in October. They generally visited our camps in pairs, and were very tame and audacious, their manner of flight resembling that of the Great Shrike, (*Lanius borealis*). This species has a most disagreeable sneaking appearance when seen hopping from branch to branch waiting for a favourable opportunity to make off with a piece of pork. The young are nearly full-grown by the middle of July, and then exactly resemble the figure of *G. Brachyrynchus* in Richardson's "Fauna Boreali Americana."

45. *Vireo olivaceus*, Linn. (Red-eyed Greenlet).—Common throughout the district up to 25th August.

46. *Bombycilla Carolinensis*, Briss. (Cedar Bird, "Cherry-bird").—Not numerous, and only about clearings.

47. *Sitta Canadensis*, Linn. (Red-bellied Nuthatch).—Occasionally seen throughout the district during the summer. First observed May 26th, last seen September the 20th. It was very numerous at Hamilton's Farm on the 28th August for a short time.

48. *Trochilus colubris*, Linn. (Ruby-throated Humming-bird).

—On 27th May when lying on the ground, on an island in Sixteen Island Lake, cleaning photographic plates, a splendid male humming-bird hovered for some minutes within a yard of my face. This was the first date at which I observed it, and it was afterwards occasionally seen up to the 12th August.

49. *Alcedo alcyon*, Linn. (Belted Kingfisher).—Very abundant the whole way up the River Rouge, breeding in holes in the high and precipitous sand-cliffs, which skirt the river in many parts. The young birds were almost full-grown about the middle of July. The last noticed was on the 11th October. It is but rarely seen on the Lakes, though so numerous on the river.

50. *Picus pileatus*, Linn. (Pileated Woodpecker, "Log cock"). —Rather rare in this district. A fine female was shot on Sixteen Island Lake May 27th, and on dissecting it I found the eggs of small size. The stomach and crop were stuffed full of large black wood-ants, and *Elateridous* larvæ. Another was seen on the Rouge August 8th. This fine Woodpecker when seen hopping up the trunk of a tree might easily be mistaken for some animal, its movements being so unlike those of a bird.

51. *P. villosus*, Linn. (Hairy Woodpecker).—Numerous in the woods of the Township of Grenville, Harrington and Wentworth in spring.

52. *P. pubescens*, Linn. (Downy Woodpecker).—Occurred occasionally throughout the district.

53. *P. varius*, Linn. (Yellow-bellied Woodpecker) I shot a fine male, May 27th at Sixteen Island Lake, and saw one or two September 12th and 13th at Trembling Lake.

54. *P. arcticus*, Swains. (Arctic Three-toed Woodpecker).— Observed one specimen in the Township of Harrington, October 15th.

55. *P. auratus*, Linn. (Golden-winged Woodpecker).—None seen till we reached Hamilton's Farm, where it was not uncommon at the end of August, and beginning of September, many being birds of the year. The skin of the neck of this Woodpecker, unlike that of the other species, passes easily over the skull when skinned.

56. *Coccyzus erythropthalamus*, Wils. (Black-billed Cuckoo). Camp on Sugar-bush Lake, 3rd Range Montcalm, June 25th, and Indian Village, Arundel, July 16th.

57. *Ectopistes migratoria*, Linn. (Passenger Pigeon).—A few observed in the woods throughout the district during the spring

and summer, a flock seen at Hamilton's Farm September 3rd, and a solitary specimen remained feeding on the fields there till October 7th.

58. *Tetrao umbellus*, Linn. (Ruffed Grouse, "Partridge").—Abundant in the woods throughout the district, but especially on the Rouge, and the numerous covies met with afforded our party many a hearty meal. In May their crops were stuffed with the heads of *Trillium*, *Ferns*, &c., and large, spotted Slugs (*Tebennophorus caroliniensis*). In July they feed on the berries of the Fly Honey suckle (*Lonicera ciliata*), Dwarf Raspberry, (*Rubus triflorus*), Clintonia (*C. borealis*) &c. In August on the fruits of the Blackberry (*Rubus villosus*), and creeping Snow-berry (*Chiogenes hispidula*), with which their crops were literally crammed, and also on a Lepidopterous larva which feeds in great numbers on the soft maple (*Acer rubrum*). The males were heard drumming till the end of June. The young were half-grown about the middle of July,and remained in covies till the end of August, about which time they are full grown, and begin to separate. With the aid of a dog these birds are very readily obtained, for as soon as the dog begins to bark they fly up into the trees and are there easily shot, as they remain quite still, apparently trusting for concealment to their colour which so nearly resembles in tint the bark of a tree. I frequently saw them strutting about amongst the bushes within a few yards of me, and they will occasionally remain in a tree for a second shot if missed at the first discharge. Young birds often have worms several inches long amongst the intestines,

59. *Fulica Americana*, Gmel. (American Coot).—A pair seen September 14th in a small lake near the Lake of Three Mountains.

60. *Totanus macularius*, Wils. (Spotted Sandpiper).—Several pairs were seen on Sixteen Island Lake in May. It was very common the whole way up the Rouge to Hamilton's Farm, and was frequently observed in the numerous small lakes of the district. The last was seen on the 10th October.

61. *T. solitarius*, Wils. (Solitary Sandpiper).—First seen on the Rouge August 12th, when a pair were shot. Several were observed up to 13th September.

62. *T. vociferus*, Wils. (Tell-tale Tatler).—A solitary specimen seen on Trembling Lake, September 11th.

63. *Microptera Americana*, Aud. (Wood cock).—Said to have been heard in the swamps about Hamilton's Farm September 2nd, but none were seen.

64. *Ardea nycticorax*, Linn. (Night Heron).—A pair seen flying over head when camped near Gate Lake May 17th.

65. *A. lentiginosa*, Swains. (Bittern, "Indian Hen.")—An *Ardea*, supposed to be this species, was frequently seen at Bevin's Lake in July.

66. *Anas obscura*, Gmel. (Black Duck).—Frequently seen on Sixteen Island Lake at the end of May, and a nest was found there at the beginning of June containing ten eggs. A female with a large brood was seen on Bevin's Lake June 25th, and numerous other broods were met with up the Rouge, and in the small lakes on either side in July, at the end of which month many of the young birds could fly strongly. Whenever we gave chase to a Black Duck and her young, the latter would separate in all directions and dive as soon as the canoe came too close, but the old bird flapped along the water as though unable to rise, until the little ducks had concealed themselves in the bushes along the shore, then she would get up, and fly back over our heads. We found the half grown "flappers" which were shot, very delicate eating.

67. *A. sponsa*, Linn. (Bush Duck).—One seen on Bevin's Lake October 16th.

68. *A. discors*, Linn. (Blue-winged Teal).—One observed on Trembling Lake September 11th.

69. *Fuligula marila*, Linn. (Scaup Duck).—I saw some Ducks which resembled this species on Sixteen Island Lake May 20th.

70. *F. clangula*, Linn. (Golden-eyed Duck).—Frequently seen on Sixteen Island Lake in May. A young one nearly full grown, was shot on the Devil's River July 20th.

71. *Mergus serrator*, Linn. (Red-breasted Merganser).—Often observed on the Lakes in Wentworth and Montcalm in May and June. A young bird was shot on the Rouge, August 5th. They became very numerous on the Rouge and in all the lakes about the first week in September, and continued so till the middle of October. Many were shot and eaten but were very fishy in flavor. When at Trembling Lake on 10th September, several immature individuals of this species alighted on the water within ten yards of our canoe.

72. *Mergus cucullatus*, Linn. (Hooded Merganser).—An immature merganser resembling the young of this species was shot on the Lake of Three Mountains September 23rd, and another was seen two day's after.

73. *Larus argentatus*, Brunnich. (Herring Gull).—A large Gull, supposed to be this species, was frequently seen at the end of May on Sixteen Island Lake.

74. *Colymbus glacialis*, Linn. (Great Northern Diver, "Loon"). This fine bird was seen in almost every lake visited by us, even including the remarkable one about a quarter of a mile long, on the top of "Silver Mountain" on the Rouge, about five miles above the "Huckleberry Rapids," Lot 40th., Range 2nd., De Salaberry. It is never seen in the Rouge, though so numerous in the lakes. All observed were very shy and rarely approached within shot. They are however frequently killed by the Indians who make handsome tobacco pouches and purses from the skin of the neck of the male. One immature specimen nearly as large as an old bird was shot October 5th.

75. *Podiceps Carolinensis?* Lath. (Pied-billed Dobchick, or Grebe).—A Grebe which I took to be this species, was observed by me on Chain Lake, Montcalm, June 14th.

The Rice-Bunting, or "Bob-o-link" (*Dolichonyx orizivora*), and the Red-headed Woodpecker (*Picus erythrocephalus*) were observed about Point Fortune, opposite Carillon on the Ottawa, but were not met with in the woods.

REPTILIA.

It is not improbable that the following list includes nearly all the Reptiles which occur in the district.

1. *Chelydra serpentina*, Schw. *Emysaurus serpentina*, Linn. (Snapping Turtle or Tortoise).—In October I was given a shell of this species by G. W. Allbright, Esq., P.L.S., who obtained it during the past summer up the Devil's River, a tributary of the Rouge, having its origin in Trembling Lake, and running through the Townships of Grandison and De Salaberry. The carapace measures a foot in length, and nine inches in breadth, and shows the mark of a burning brand applied to the shell to make the poor animal put out its head. I was not fortunate enough to see any living specimens, but Turtles are reported to be frequently met with in the lakes of the district, and to reach a large size.

2. *Glyptemys insculpta*, Agassiz. *Emys insculpta*, Le Conte. (Sculptured Tortoise).—When camped near Mr. Thompson's house in the 15th Lot, 3rd Range, Arundel, I was shown the shell of a specimen obtained on a small sandy island in the Rouge opposite the clearing, where they are said to be not uncommon, and I was informed that sixty-eight eggs, of which I saw one, were found in

the sand there. I also obtained a fragment of a shell of this species at the mouth of the Devil's River.

3. *Eutainia sirtalis*, Baird & Girard. *Tropidonotus sirtalis*, Holbrook. (Garter or Striped Snake).—We met with no snakes till we reached the chute on the Rouge called "Huckle-berry Rapids," and sometimes "Black-lead Falls," from the quantity of Graphite in the Crystalline Limestone there, in the 30th Lot 2nd Range De Salaberry. Here this species was quite numerous amongst the Limestone rocks in open places, at the end of July and beginning of August, and at Hamilton's Farm August 31st, I saw one plunging about in the river, having apparently accidentally fallen in from off the steep bank, but it reached the shore and escaped amongst the herbage before I could secure it. In my way down to Grenville on 12th October, I saw great numbers lying crushed on the road through the Townships of Harrington and Grenville. No other Ophidian Reptile was seen, but reports of a "Water Snake," said to inhabit the lakes, came to my knowledge.

4. *Rana Catesbiana*, Shaw, *pipiens*, Holbrook. (Bull Frog). —Abounds in every lake and pond throughout the district, and the curious tadpoles of this species were to be seen during the whole season.

5. *R. nigricans*, Agassiz. (see Agassiz, "Lake Superior" p. 879).—Abundant at Sixteen Island, Chain, and Sugar-bush Lakes, Montcalm, at the end of May and June.

6. *R. pipiens*, Gmel., *halecina*, Holbrook et aliorum. (Leopard Frog) Abundant in Sugar-bush Lake, Montcalm, in June.

7. *Hyla versicolor?* Le Conte. (Tree Frog).—"Tree Frogs" probably of this species were said to have been heard about Sixteen Island Lake at the end of May. None were obtained.

8. *Bufo Americana*, Le Conte (American Toad).—Common throughout the district. When camped at the Indian Village on the Rouge, Lot 16, Range 7, Arundel, it was most extraordinary to watch the toads assembling at night round our fire, attracted by its light, and after staring at it with astonishment for a few minutes, suddenly jump into it and quickly scramble out again half roasted. On 31st July at "Huckleberry Rapids," vast numbers of little toads were hopping about in the bed of a small creek there.

9. *Plethodon erythronota*, Green. (Red-backed Salamander). —Abundant under the bark of dead logs &c., in the Townships of Wentworth and Montcalm in May.

10. *Spelerpes bilineata*, Green. (Two-lined Salamander).—Common under dead logs, &c., in moist places, in the Township of Montcalm at the end of May and June.

11. *Triton ?* (undetermined).—One specimen taken in Sixteen Island Lake June 2nd.

A "Lizard" was reported as inhabiting a small stream crossing the portage between Gut and Gate Lakes, Wentworth, but I failed to obtain specimens when I sought for it.

PISCES.

Owing to the extreme difficulty of transporting alcoholic specimens across the portages, I collected but a limited number of fish, and there are doubtless a great number of species, besides those enumerated, to be found in the innumerable lakes of the district. The Fauna of these lakes, from various causes, frequently varies very much, and a careful comparison of the fish inhabiting each, would furnish a most interesting field of enquiry, and would doubtless tend to throw much light on Geographical Distribution and the Variation of Species. This, however, could only be accomplished by a person having abundance of time at his command, and well furnished with the means of obtaining and transporting specimens. Another great obstacle in carrying out such an examination, would be the total absence in this country of any collection worth mentioning of North American Fish, with which the specimens collected could be compared, and the want of some good and complete work on the subject. These difficulties I have myself severely felt in prosecuting my researches for the present paper, and in determining the few specimens which I brought home I received much assistance from Prof. Dawson, the Principal of McGill College, to whom I am also indebted for the loan of various works on North American Zoology.

1. *Pimelodus cœnosus*, Richardson. (Cat-fish, "Barbeau").—Very abundant in a small lake, 11th Lot, 3rd Range, and Sugarbush, Bevin's and Bark Lakes, Montcalm. All these lakes have muddy or sandy bottoms with sloping shores in most parts, and communicate without much fall with the Rouge. During the day-time this fish remains at the bottom slowly moving about, but in the evening rises at flies on the surface of the water. At dusk they may be caught with pork as a bait, and are also easily speared by torch-light. They are very tenacious of life, and I have known them live a whole night out of water, an interesting

fact connected with the reptilian character of the class of fish to which the genus belongs. Before being cooked they are thrown into the hot ashes of the fire for a few seconds, until the slimy skin peels off, after which they are fried with pork-grease and taste much like eels. When bathing in Sugar-bush Lake great numbers of small chub crowded round me, and a Cat-fish of some size nibbled at my leg.

2. *Perca flavescens*, Cuvier. (Yellow Perch).—This fish was numerous in the same lakes as the Cat-fish, and also in a lake about three miles east of Hamilton's Farm, communicating with the Devil's River. It did not reach any size nor did it take a bait very freely. In these beautiful lakes, with their clear water, it is most interesting to watch the habits of the various small fish congregating round the shores, amongst which the perch is conspicuous from its striped sides.

2. *Esox boreus*? Agassiz. (Pike). The specimen which I preserved was caught in the small lake previously mentioned in the 11th Lot, 3rd Range, Montcalm, and agrees very well with the destription of *E. Boreus* in Agassiz's "Lake Superior" p. 317, with the exception that the lateral line is very indistinct instead of being "very distinct." It does not agree with *E. lucius* as described by Yarrel, though it does in most particulars with the description of that species given by Richardson in "Fauna Boreali Americana." It had a small leech-like parasite adhering to its side. The average weight of those we caught was two pounds, and the length eighteen inches. The largest taken in Bevin's Lake, measured twenty-four inches in length, eight and a half inches round the body over the pectoral fins, and weighed four pounds. The mouth is very tender and tears very much when hooked, but they will bite freely even though struck and lost several times. They frequently jump over the bait if it is pulled too rapidly through the water. We used as bait fat-pork, squirrel, *leucisci*, pieces of trout, frogs, and the animals of *Anodonta*, all of which they took readily, often biting at Chub (*Leucisci*) even ten inches long. Before a thunder storm they rushed up to the bait, but would not bite at it. We also captured them in gill-nets made of pack-thread and set at night with stakes. They would bite through the fine gimp of our tackle if it got between their teeth and frequently escaped in that manner. It was amusing to see the shoals of small fish throw themselves desperately out of the water when one of these voracious pikes rushed amongst them. Pike were nume-

rous in the same lakes as the Cat-fish and Perch, and all the way up the Rouge as far as we ascended.

The three above species were almost always found together and there were never any trout in the lakes which they inhabited.

4. *Salmo fontinalis*, Mitchill. (Brook or Spotted Trout).—Abounds in nearly all the lakes and brooks through the district. One specimen only was taken in the River Rouge itself, and it is not found in those lakes in which the Cat-fish, Perch and Pike occur, nor in their outlets, though frequently abundant in the small streams flowing into them. In May, at Sixteen Island Lake, we found the best time to fish for trout was after sunset, when they approached the shores to feed in the shallow water. Those taken in this lake varied very much in color and markings, some specimens being entirely dark silvery lead-color with a few very small scarlet spots about the lateral line, whilst others were light yellowish brown, with large and numerous scarlet spots. Many were marked with large irregular black patches on the back and sides giving them a very peculiar appearance. They were much less brilliant in their tints here than in the small lakes and streams we afterwards visited. The largest specimen of the lead-colored variety, which was very numerous, measured fifteen and a half inches in length, and seven inches round the body behind the pectoral fins. The young fry banded with black and about an inch long, were very numerous May 19th, in a small stream running into the lake. After leaving Sixteen Island Lake in June, we found all the small lakes and streams between Balsam or Chain Lake and the one in the 11th Lot 3rd Range Montcalm, swarming with trout, which lay in shoals in the pools of the streams, and in the shallows at their entrance into the lakes, watching for any prey which the water might bring down. In such places the water was so clear, it was necessary to take great care in concealing oneself, as the least movement caused all the fish to dart away, and they would only bite when a puff of wind ruffled the surface of the water. In the cold deep lakes they took the bait very quietly and gently, and it was often difficult to tell when we had a bite, for as there was no current they could examine any object which looked tempting at their leisure, but in the rapid streams, foaming and tumbling over rocks and prostrate trees, they left their concealment beneath some projecting rock or fallen log at the moment the bait touched the water, and dashed at it with so much violence that they were frequently hooked in the body by rushing over it. They were

quite as voracious as the pike, and on one occasion I landed a small trout which had a "chub" sticking half out of its mouth having been too large for its captor to swallow entirely. In general the pool below each little fall on a brook was inhabited by a single trout, which in such places rarely exceeded six or seven inches in length and was usually much smaller. In summer when the small creeks running into the Rouge were almost dried up, it was wonderful how the trout, even of considerable size, contrived to conceal themselves, when disturbed, behind every little stick or stone in the water. Those we caught on the 8th September in a stream flowing into Trembling Lake were full of spawn of the size of duck shot, but the larger ones in the lake itself would not bite, on the 10th however, they began to bite again in the Lake of Three Mountains, and during the remainder of the month and first week of October we captured great numbers of fine trout in that lake and the numerous others connected with it. They lay in shoals amongst the *Equiseti* which grow thickly at the mouths of the creeks running from one lake to another. At this season of the year when the Mosquitoes, Black and Sand-flies have ceased to be troublesome, and the hills clothed with trees, in their autumnal hues, vie in richness of coloring with the splendid trout themselves lying struggling and gasping at the bottom of the canoe, nothing can be more delightful than a day's fishing in one of these retired lakes, whose calm and tranquil surface is undisturbed by anything save the dimples caused by the rising of the lazy fish, by the flocks of Mergansers as they hurriedly rise at our approach, or by the white breasts of the loons popping up here and there after a long sustained dive. Nothing however, could be less artistic than our mode of catching these beautiful fish, now at their prime, fat and full of strength from their summer's feast on the flies, and biting in a very different manner from those taken in spring when they are weak and languid after their long winter's fast. Our implements consisted of a fir pole, a few yards of whip-cord and a mackarel hook, with a lump of fat pork or a piece of a squirrel for a bait. We usually fished from a canoe, as the trees everywhere growing down to the water's edge rendered it impossible to throw our lines without entangling them in their branches, and it is somewhat nervous work when three persons fish from a small bark canoe, and the trout kicking and plunging on the lines causes the frail craft to roll from side to side in anything but an agreeable manner. Their coloring varied very much, some were like those

of Sixteen Island Lake, silvery lead-color with small red spots, others very light salmon-color, a little darker on the back, with the scarlet spots very distinct, whilst others again were pale olive brown with salmon-colored bellies. One beautiful specimen was very deep salmon-color on the belly, pale silvery blue on the sides, with large and brilliant scarlet spots, and the back almost black spotted with yellow, the tail purplish with a submarginal band of lake and margined with white. The ventral and pectoral fins of all were salmon-colored with a broad streak of white on the outer margin. The males were generally much brighter that the females, and were of a brilliant orange color on the belly instead of pale salmon-color; the cartilaginous projection on the lower jaw was much grown over the mouth as is usual in the breeding season. The females, which were at least two to one of the males, were full of spawn. The average size of the trout in these lakes was from twelve to twenty inches in length, and from six and a half to nine and a half inches in girth, the heaviest weighing about four pounds.

5. *Salmo*? (Grey Lake Trout).—This species, which I have been unable to determine, was first met with in May at Sixteen Island Lake where we caught several fine specimens of four or five pounds in weight, measuring twenty-three inches in length and ten inches in girth behind the pectoral fins. At that time they took our bait in a very sluggish manner and afforded no sport whatever, giving merely a dead pull when hooked. The flesh is pale buffish white and is not nearly so rich in flavor as that of the last species, which is deep salmon-color. They begin to bite much later in the autumn than the Spotted Trout or about the middle of October, and were not so abundant as that species, being found only in the larger Lakes, viz. Sixteen Island, Trembling and Three Mountain Lakes.

6. *Coregonus*? (White-fish).—When at Bevin's Lake on 15th October I saw several specimens of a *Coregonus* which had been just taken with a net in that Lake. As I was unable to preserve specimens I cannot determine the species. There were none in the Lake when we were camped there in June and July, at least we took none in our net.

7. *Catastomus.* Two species of "Sucker" were said to have been taken in Sixteen Island Lake whilst I was absent, and were spoken of as the "Mullet" and "Black Sucker." One was also caught in Bevin's Lake in June, but unfortunately I did not see any specimens myself.

8. *Leuciscus?* A large fish, known as "the Carp," usually about seventeen inches in length, and about two pounds in weight, was abundant in all the lakes, and in the Rouge and Devil's River, readily taking pork, smaller *leu isci* or any kind of flesh. On the sides the scales have a beautiful bronze or golden lustre, and the basal half and margin of each is black. The fin rays are as follows: Br. 3. D. 9. C. 20. V. 8. P. 16. The anterior ray of the pectorals is very strong and thick. In many specimens the snout was armed with numerous small turbercles, but others were entirely destitute of them or possessed them in a rudimentary state only. On the 5th August I saw many heaps of small stones in shallow parts of the Rouge, said to be piled up by this fish to cover its spawn. They bite best about the middle of the day, and we found them good eating, at least when we could obtain no trout. This species may be *Cyprinus corporalis*, Mitchill, but does not agree satisfactorily with any fish I have seen described.

9. *Leuciscus pulchellus*, Storer. (Chub).—This was the most abundant fish in all the lakes and rivers throughout the district. Its usual length being between eight and ten inches. My specimens agree very well with *L. pulchellus* as described by Thompson in his "Natural History of Vermont," but there is considerable discrepancy between his description and that given by De Kay in his volume of the New York Fauna.

10. *Leuciscus frontalis*, Agassiz. Abundant in streams flowing into the small lake 11th Lot, 3rd Range, Montcalm. The specimens collected agree exactly with the figure and description of this species in Agassiz's "Lake Superior," with the exception that instead of *fourteen* they have *sixteen* rays in their pectoral fins.

11. *Leuciscus?* A small species with three bony tubercles on each side of the head in a line over the eye, was common in the same stream with the last. I cannot find it described though evidently a very distinct species.

All the Lakes swarmed with the young of various *Leucisci* which are called "Dace" and "Chub." Several species besides those above mentioned were met with in Trembling and Three Mountain Lakes, but as I had then no means of preserving specimens I cannot determine the species.

One small *Leuciscus* which I took in Chain Lake, Montcalm, had the abdomen immensely distended, and on opening it I found the whole cavity occupied by an intestinal worm. The fish itself was but two and a quarter inches in length, and the worm when

extended was fully three and a half inches long, and two lines in breadth. It was very flat with a deep groove down the middle and transversely striated. The intestines, &c., were very small and the worm was closely knotted and twisted together and intermingled with them.

(To be continued.)

ARTICLE XX.—*Contributions to Meteorology: from observations taken at St. Martin, Isle Jesus, Canada East.* By CHARLES SMALLWOOD, M.D., LL.D, Professor of Meteorology in the University of McGill College, Montreal.*

The following observations extend over the year 1858: The Geographical co-ordinaries of the Observatory are Latitude 45°32′, North, and Longitude 73°36′, West, from Greenwich. The cistern of the Barometer is 118 feet above the leved of the Sea, the Mean results are obtained from tri-daily observations taken at 6 a.m., 2 p.m., and 10 p.m., and the whole of the observations have been subjected to the usual corrections, depending on the constructions of the instruments and for temperature.

Barometic Pressure.—The highest reading of the Barometer during the year, was at 10 p.m., on the 22nd of January, and indicated 30.697 inches. The lowest reading for the same period occured at 2 p.m., on the 21st of March, and was 29.021 inches, giving a yearly range of 1.676 inches. The greatest monthly range was in January, and this holds good for a series of years, with the exception of last year, 1857, when December indicated the greatest monthly range. June of the present year indicated the lowest monthly range, 0.660 inches, although July for a series of years has indicated the least monthly range. This year July exceeded by 0.014 the lowest range of June. The mean barometic pressure for the year was 29.829, which exceeds by 0.071 inches the mean of last year, and shows an increase in pressure of the atmosphere compared with a series of years. The mean height of the barometer for the month of January was 29.907 inches; for February, 29,809; for March, 29.804; for April, 29.757; for May, 29.751 inches; for June, 29.771 inches; for July, 29.759 inches; for August, 29.789 inches; for September, 29.830 inches; for October, 29.982 inches; for November, 29.779 inches; for December, 30.015 inches. The mean monthly range of the baro-

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* From the Canadian Journal for July, 1859.

meter for the month of January was 1.627 inches ; for February, 1.129 inches ; for March, 1.340 inches ; for April, 0.947 inches ; for May, 1.039 inches for June, 0.660 inches ; for July, 0.674 inches ; for August, 0.714 inches ; for September, 1.221 inches ; for October, 1.032 inches ; for November, 0.856 inches ; and for December, 1.241 inches.

The greatest range within twenty-four hours, with a rising column, occurred on the 21st January, and was 0.730 inches ; and the greatest range, with a falling column, was on the 10th of January, and indicated 0.903 inches. The most sudden variation, with a rising column, occured on the 18th of June, and from 3 p.m. to 3.20 p.m. (*Twenty minutes*) indicated a rise of 0.075 inches. The *Symmetrical wave of November* exhibited but little fluctuation, the final trough terminated at 6 a.m. on the 30th day.

Temperature of the Atmosphere.—The mean temperature for the year was 40°.04 Fahrenheit, which shows a decrease in temperature of 0°.53 compared with the temperature of 1857, and indicates 1°.520 less than the mean temperature for a series of years. The lowest observed temperature was on the 13th of February, and indicated 30°.2 below zero. The highest temperature occured on the 7th of July, and was 99°.3. giving a yearly range or climatic difference of 129°8. *February* was the coldest *February* on record here, and indicated 14°05 colder than the mean of last February, 1857. The highest degree of temperature for the month was 39°.4, and the lowest 30°.2 below zero. The most sudden decrease of temperature occurred on the 18th of June, and indicated in twenty minutes a decrease of 17°.1 ; the thermometer standing at 3 p.m. at 93°8, and at 3.20 p.m. 76°.7 The mean temperature of the air for the month of January was 13°.76 ; for February, 7°.56 ; for March, 23°52 ; for April, 39°.06 ; for May, 63°.02 ; for June, 67°.21 ; for July, 66°.50 ; for August, 66°.12 ; for September, 59°.13 ; for October, 46°48 ; for November, 26°78 ; and for December, 12°.37. July which has for a series of years indicated the greatest *mean* temperature showed this year 0°.71 less than the *mean* temperature of June. This was owing to the low temperature accompanying the excessive rain of the month of July.

Humidity.—The relative mean humidity of the atmosphere for the year (saturation being 1,000) was 0.778. July indicated 0.074 of moisture more than the *mean* of a series of years. The mean humidity for the month of January was .786 ; for February,

.703 ; for March, 789 ; for April, .717 ; for May, .764 ; for June, .756 ; for July, .818 ; for August, .81 8 ; for September, .804 ; for October, .792 ; for November, .809; and for December, .787. Complete saturation occurred in July, and is the only instance on record here of such an occurrence.

Rain fell on 111 days, amounting to 50,035 inches on the surface. It was raining 521 hours, 33 minutes, and was accompanied by thunder and lightning on 20 days. This amount of rain exceeds by upwards of 7 inches the usual average amount compared with a series of years, and was owing to excessive rains in June and July.

A very heavy storm of rain occurred on the 10th of June, which lasted 28 hours and 48 minutes, and amounted to 6.175 inches. There fell in one hour (from 5 to 6 p.m.) 0.933 inches, and from 6 p.m. to 7.28 p.m. the amount of 1.333 inches. The river surrounding this Island rose 8 inches in height.

Another storm of heavy rain set in at 3 a.m. on the 12th day of July, and ceased at 12.40 p.m. of the 13th, and indicated a depth of rain on the surface of 6.374 inches; it was acompanied by a N.E. by E. wind. The river in the neighbourhood rose nearly 2 feet in perpendicular height, and the amount of rain which fell during this month was 12.214 inches, and is the most rainy *July* on record. The amount of rain which fell in the month of August was less than the usual mean quantity for that month.

Snow fell on 46 days, amounting to 58.96 inches in depth ; it was snowing 281 hours, 30 minutes ; this amount shows a decrease equal to 36.80 inches compared with the mean amount of a series of years. February and December were the months which showed the greatest amount of snow. The first snow of the season fell on the 4th of November, and the last snow of spring fell on the 21st April.

Evaporation.—The amount of evaporation from the surface of water, during the seven months which the observations are recorded (owing to the presence of frost) amounted to 18.730 inches, which is 1.515 inches less than the usual amount of last year. July indicated about 1 inch less than the usual amount ; the amount of ice evaporated during the remaining months of the winter season showed about the usual average amount.

Wind.—The most prevalent wind during the year was the N.-E. by E. The next in frequency the W. by N., and the least

prevalent the S. The aggregate amount linear in miles run was 41,338.60 miles, which shows a decrease of 13,086.50 miles compared with last year, and a decrease of 11,723 03 miles compared with 1856. The yearly mean velocity was 4.613 miles per hour, which is 1.567 miles less than the mean annual velocity for 1857, The maximum velocity was 37.70 miles per hour. January was the most windy month, and September the calmest.

The greatest *Intensity of the Sun's Rays* was 117°, and the lowest point of *terrestrial radiation*, 31°.2 below zero.

The yearly amount of *Dew* was considerably below the usual mean amount compared with a series of years.

There were 56 days perfectly cloudless, which is 25 more than the cloudless days of 1857. There were 118 nights suitable for astronomical purposes.

The Aurora Borealis was visible at observation hours on 39 nights. *Lunar Haloes* were seen on 4 nights. The *Zodiacal Light* was very bright in February, but since then has exhibited no special appearance. *Parhelia* were visible on 2 days.

The Eclipse of the Moon was *visible* on the 27th February. The Eclipse of the Sun was *invisible* on the 15th March owing to cloudy weather.

The winter of 1857-58 fairly set in on the 22nd December 1857.

Ozone.—The amount of ozone during the year has shown an increase on the usual average. Observations are now being taken here, intended to shows the effects of the different coloured rays of light on the Ozonecometer, and also the effects of vegetation on the amount.

Atmospheric Electricity.—The tri-daily observations are still continued in this important branch of science, the amount indicated in frequency and tension is very near equal to the amount of last year, but is nevertheless rather below the usual average. The *Romershausen* apparatus seems pretty well adapted for the purpose of collecting atmospheric electricity, bnt is inferior to the large apparatus which is erected here, both as to collecting and retaining the electric charge.

The Song Sparrow (*Fringilla Melodia*) the harbinger of spring, first heard on the 10th March. Swallows (*Hirundo Rufa*) first seen the 15th April. Frogs (*Rana*) first heard the 15th April (this is about a week earlier than usual,) Shad (*Alosa*) first caught 29th May. Fire-flies (*Lampyris Corusca*) first seen the 18th of

June. Snow Birds (*Plectrophanes Nivalis*) first seen 26th October. Crows did not winter here this year. Wild Strawberries in flower 27th May, and matured 26th June. Gooseberry in leaf 9th May. Currant tree in leaf 21st May. Plum tree in blossom 26th May. Apple tree in leaf 3rd June.

The potatoe rot, which manifested itself but partially this year, commenced in this neighbourhood on the night of the 7th August.

St. Martin, Isle Jesus, 21st March, 1859.

ARTICLE XXI.—*The Oxford Museum.* By H. W. ACLAND, M.D. and JOHN RUSKIN, M.A. (SMITH ELDER & Co.)

[*From the Athenæum.*]

THE University of Oxford has distinguished itself by a bold educational movement. Partly by external pressure, partly by internal pressure, partly by internal sympathetic force, "it has greatly advanced those pillars in the learned world which seemed immovable." In spite of the forebodings of many excellent persons who have a nervous dread of the unknown, the restorative effect of geology, chemistry, natural science, and languages less ancient than Greek and Latin, is beginning to be tried upon the constitution of the University. Oxford is changed for the better. The body for which Mr. Gladstone appears in Parliament is not that for which Sir Robert Inglis sat. The former gentleman does not represent the past so much as the present and the future. He is not the expression of Palæozoic Oxford—the Oxford of the insular self-existing period—but Oxford after the attrition of young and vigorous intellect—the Oxford of the later measures—demiurgic Oxford, within the compass of the telegraph and the railway, and distant only an hour and a half from the metropolis.

The time was in Oxford when to be conscious of German, or not to believe in the Ptolemaic system, was an offence against the Statues and against good manners. What undergraduate dared visit the libraries, though he was assessed for them, or ransack the MS. treasures of the Bodleian? Now and then an adventurous German lifted the veil of dust, and gained a brief sight of valuable long-buried Sanscrit or Syriac information. For what have not Germans dared? How have they not affrighted the *Dii majores* of primeval Oxford! *Nolo hanc universitatem Germanizari*, was the last famous denunciation of the old time—but like the last bard, that traditional Don has vanished. Few emblems of the

ancient time remain now in Oxford. The examinations have passed away or have other names. To be sure there are some old tests which are preserved, but only to denote the epoch—as the Trilobites indicate the Silurian era. There still are prison gratings to the College windows—strong bolts and locks to the ponderous College-gates,—the Vice-Chancellor is still environed by a procession of pokers,—still the porter keeps the gate, regardless of the signs of the times, "of foreign levy or domestic treason," intent only upon the hour of nine, the tolling of Great Tom and the periodicity of gate-fines. Otherwise, Oxford is changed. She no longer thinks fit to exert her right in suppressing an unimportant book or in raising a harmless Professor into an inconvenient notoriety,—she leaves heterodoxy to die a natural and obscure death, and addresses herself to her proper function of circulating positive and practical truth and becoming a central light to the towns of industrial England. We have noted with pleasure the gradual extinction of the ol town-and-gown feud,—the urbanity of the University in sallying forth as in earlier times from its walls,—and lastly, the proposal to convert the Radcliffe Library into a free library, where artizan readers shall be admitted by night—as in some good time coming we may hope to see them admitted within the walls of a National Library. The influx of a still more healthy element we have to record in the completion of a Museum for Science. This has long been felt a want in Oxford. A knowledge of words rather than of things was the great aim of the ancient time. Half of the pedantry of the place arose from the pride of classical lore and over-bookishness.

Ethics were better understood than Physics—Aristotle's 'Organon' than his 'Physica.' It does seem strange, as Dr. Acland well puts it, that "it has taken some centuries from the epoch of Roger Bacon, followed here by Boyle, Harvey, Linacre and Sydenham, besides nearly 200 years of unbroken publication of the Royal Society's Transactions, to persuade this great English University to engraft, as a substantive part of the education of her youth, any knowledge of the great material design of which the Supreme Master-Worker has made us a constituent part."

We have heard one university authority argue that the Ptolemaic system was more conducive to religion than the Copernican, and we learn that not long ago a Head of a college seriously alluded in a university sermon to the "mysterious convolutions of domestic furniture." That religion has nothing to fear, but everything to

hope and gain, from the increase of scientific light, is only beginning to be gradually understood at Oxford, as elsewhere. It is pleasant to observe, at the time when Cambridge is inviting Prof. Owen to deliver a lecture on Comparative Anatomy, so interesting a phenomenon as the completion of a Scientific Museum in Oxford. Its ultimate success, no doubt, will depend more upon the ability and energy of the Professors and its practical and liberal character than upon the beauty and symmetry of its stones. Yet the outward visible fact makes us hopeful of the inward spiritual grace. Taking into account the influence which such a Museum may have in training future clergymen in principles of sanitary science, and modernizing future legislators and country gentlemen, the importance of the fact cannot be over-estimated. Still more, if, as we hope, working men are to be admitted to the Lectures of the Museum :—for why should not Oxford offer advantages to all, like Edinburgh or Glasgow?—and what may we not hope from our highest University when we remember that a Watt, a Ferguson and a Livingstone have been produced from the Scotch school of science?

The Oxford Museum consists of Schools of Chemistry, Natural Philosophy and Anatomy,—and is provided with suitable appendages in the shape of Lecture-rooms, laboratories, a library and reading-rooms. The large sum of 30,000*l*, was voted by the University for the object; and after public competition, the Gothic design of Messrs. Dean & Woodward was chosen as being on the whole most suitable for the purposes of the foundation. The sum voted allowed no margin for ornament, and barely provided the shell of the building.—What was wanting, however, the munificence of many persons, illustrious from position or learning, has supplied. Her Majesty set a noble example by offering to give five of the statues with which it was proposed to adorn the corbel of the arcade. Mr. Ruskin gave 300*l*. for the decoration of the windows ;—Dr. Acland, one of the earliest promoters of the building, followed by eminent scientific men, gave shafts or capitals—money for inscriptions or sculptures, as their taste inclined :—the under-graduates and bachelors gave statues ;—and even Cambridge Professors forgot their ancient rivalry, and contributed what was wanted. Not the least pleasant feature is to note among the contributors the names of some of the workmen who have been allowed to carry out their own designs. Conspicuous as contributors and workmen are a family called O'Shea, who have beau-

tified the capitals with devices fresh and original. Thus, by a pleasant co-operation, the building has grown up a noble monument of skill and endeavour and social goodwill. We trust it may entirely fulfil the intention of its promoters. It does not yet fulfil all that we should like to see carried out in a great national building, nor reach the grandeur of a Pantheon or a Glyptothek, it expresses and embraces the modern element in its material. Sculptors, architects, workmen, University men have done their best with the sum they had at their command. The building is such a building as Goethe supplied in the Wanderjahre—a great quadrangle surrounded by an open arcade. Every part is significative, and it only differs from the Goethean conception in this, that it does not open on a flower-garden, but on an avenue of trees. Occupying the great quadrangular space in the centre is a museum, which is roofed with glass, and resting upon solid cast-iron columns lengthening out into aisles. Along the spandrils of these aisles twine and interwine in wrought ironwork, leaves with flower and fruit of chesnut or lime or symacore or walnut or palm, —and in the capitals, or nestling in the trefoils of the girders, leaves of elm, of briar, of water-lilly, passion-flower, ivy or holly. The open arcade which runs round the quadrangle is the fairest and most architectural part of the building. It consists of two storeys—from the upper one the roof springs, so that both are open to the court. "In each of the arcades are seven piers, forming eight openings, and carrying eight discharging castles, within which are two lesser arches, resting on the pier, and at their junction with each other is a shaft with a capital and base." Taking the upper and lower floor the court is surrounded by 125 shafts. The number of shafts on the western or entrance side being distinct from the eastern side, which is incomplete.

The geological structure of the British rocks is prettily illustrated by the pillars. The Professor of Geology will tell us what to see:

["In the arrangement of the many valuable and curious examples of polishable stones which the liberality of our friends has enabled us to bring together, we have always desired to employ so much of system as to make these ornamental parts of the fabric really and obviously useful as a part of the exhibition of natural objects. Regarding the rocks as of aqueous or igneous origin and of unequal geological dates, we wished to exhibit these relations in our building by giving to each group an appropriate place.

It was found, after great efforts, possible to accomplish this to a considerable extent, but not quite so perfectly as was hoped. The principal reason is, that we could not obtain certain marbles known more than one hundred and fifty years since, to complete our series of mesozoic limestone."]

"If now you will stand in the centre of the great court, and turn your eyes to the west, '*solis ad occasum*' you will see, in the lower range of the shafts, six fine examples of granite and its twin brother syenite. First, on the left, Aberdeen grey granite, surmounted by the sculptured capital of Alismaceous plants; next, Aberdeen red granite, crowned by the Butomaceæ; then the largely porphyritic grey granite of Lamorna, with a capital of the date palm. On the other side of the entrance, stands my special column of syenite from Charnwood Forest, with the cocoa-palm for its crown; then the beautiful mottled granite of Cruachan, elaborated for us by the Marquis of Breadalbane, the capital being Pontederaceæ; and finally, the red granite of Ross in Mull, the gift of the Duke of Argyll, whose capital is Liliaceous."

Shafts of red or grey or mottled granite occupy the west side; on the north, calcareous rocks, the green marbles of Galway, or the red and black limestones of Cork. Turning to the east, as is proper, we face igneous rocks:—Killerton lava rock crowned with thorny Zamia—Inverara porphyry, with a capital of pine or fir—St. Leven's porphyry and black serpentine, bearing on its head a tuft of yew. On the south, "English and Welsh marbles, mostly of carboniferous limestone, but including what are less commonly seen, the breccia of Mendip and the gypsum of Chellaston." The upper corridor follows the same order with ninety-six shafts, which still want capitals. North and east are the granites of Aberdeen, Criffel, and Cornwall—the serpentines of Galway; on the south, fronting the coeval rocks of Ireland, carboniferous Devonian limestones; while on the west are "Nottinghamshire, Derbyshire, and Somersetshire marbles—specimens of Permian limestones—in the centre granites of Jersey and Cornwall—flanked by columns of slate and shafts of lias, blue and white—marbles of Purbeck, Stamford, and Buckingham." It is on the capitals of these pillars, illustrating the Flora of England, that the workmen have been allowed to work out their own designs, and in the execution of which the O'Shea family have greatly distinguished themselves. Without entirely endorsing Mr. Ruskin's organization of labour—of "men mailed and weaponed *cap-à-pie*"

—"men inheriting the instincts of their craft through many generations—informed and refined,—then classed according to their proud capacities in ordered companies, in which every man shall know his part and take it calmly."—the capital of flowers satisfies us that we have workmen who, if properly trained and judiciously praised, may emulate what was done at Roslin or at Melrose, where

> No herb nor floweret glistened there
> But was carved in the cloister arches as fair.

[Professor Philips continues:—"Thus as far as possible the representation of plants, varied here and there by animals geographically and naturally associated with them, will be placed with so much of system as to help the memory, and will be sculptured with so much attention to the natural habit as to satisfy the botanist as well as the artist, neither of whom can expect the most skilful human hand to express in rough stone by means of hard steel all the delicacy and grace with which, by finer materials and by finer processes, the Great Artificer moulds the lilies of the field and the leaves of the forest. I need not remind you, that with this view of the utility and meaning of the arrangement of oor subjects, the architects, who have been very zealous in their efforts to make the whole successful, have been always able to combine what is due to the building as a work of art; nor am I aware that their opinion and ours have been in the least degree difficult to reconcile. We must not forget the sculptors, who have worked with singular zeal and ability. Finally, this is not a haphazard collection of pretty stones crowned by pretty flowers, but a selection of marbles and sculptures intended to illustrate points of some interest and importance in science and art. Upon the whole, you will probably not regret to have given so much time and attention to this matter. All that is told me confirms my own opinion, that it was well worth while to make this trial to combine grace with utility, and that the result will not be disappointment to those who have given us money for our work, and, what is more precious, their full confidence that we should use it with liberality and prudence."]

A series of sculptured portraits gives the crown to the building. These have been worthily entrusted to Mr. Thomas Woolner and Mr. Munro, who have entered on the work with zeal, and, we regret to learn, with self-sacrifice. Great Verulam, starry Galileo, Newton, Leibnitz, and Oersted, have fallen to the lot of Mr.

Woolner; while the statues of Aristotle, Hippocrates, Cuvier, Davy, Watt, are either unassigned, or apportioned to Mr. Munro. Statues are still wanted of Archimedes, Euclid, Pliny, Copernicus, Franklin, Herschel, Lagrange, Laplace,—of Black, Dalton, Stephenson,—of Bell, Harvey, Hunter, Jussieu, and Sydenham,—and what to ancient Oxford Dons must be a sad shock, a statue of Priestley.

Anatomy occupies the north,—that is, the coolest side. To the south, where there is most light, is a large and airy domicile for Chemistry, and an open area for experiments,—while on the south-west are spacious lecture-rooms, and on the ground-floor a laboratory, modelled from the Abbot's kitchen, at Glastonbury. Our description of the museum is complete when we have mentioned the curator's house,—a beautiful example of Gothic, occupying the eastern angle.

Thus the Museum is, as Prof. Phillips describes it,—not "a haphazard collection of pretty stones crowned by pretty flowers," but a building at once apt and expressive.

The little volume which has served as our text consists of a Lecture delivered by Dr. Acland—two letters by Mr. Ruskin—and a letter of Prof. Phillips, the Curator, each giving his opinion on the wants or aim of the building. Mr. Ruskin, who here appears as the advocate of the practical, praises the beauty of the windows, hints at the healthiness of physical studies, and the probable influence of science upon the industry of the age. The general barrenness of the facade, is with him a subject of complaint and the want of ornament on the windows. He dissuades from the use of color at present. Sculpture finds great favour :—

"As the building stands at present, there is a discouraging aspect of parsimony about it. One sees that the architect has done the utmost he could with the means at his disposal, and that just at the point of reaching what was right, he has been stopped for want of funds. This is visible in almost every stone of the edifice. It separates it with broad distinctiveness from all the other buildings in the University. It may be seen at once that our other institutions, and all our colleges—though some of them simply designed—are yet *richly* built, never pinchingly. Pieces of princely costliness, every here and there, mingle among the simplicities or severities of the student's life. What practical need, for instance, have we at Christ-church of the beautiful fan-vaulting under which we ascend to dine? We might have as easily

achieved the eminence of our banquets under a plain vault. What need have the readers in the Bodleian of the ribbed traceries which decorate its external walls? Yet which of these readers would not think that learning was insulted by their removal? And are there any of the students of Balliol devoid of gratitude for the kindly munificence of the man who gave them the beautiful sculptured brackets of their oriel window, when three massy projecting stones would have answered the purpose just as well? In these and all other regarded and pleasant portions of our colleges, we find always wealthy and worthy completion of all appointed features, which I believe is not without strong, though untraced effect, on the minds of the younger scholars, giving them respect for the branches of learning which these buildings are intended to honour, and increasing, in a certain degree, that sense of the value of delicacy and accuracy which is the first condition of advance in those branches of learning themselves. Your Museum, if you now bring it to hurried completion will convey an impression directly the reverse of this. It will have the look of a place, not where a revered system of instruction is established, but where an unadvised experiment is being disadvantageously attempted. It is yet in your power to avoid this, and to make the edifice as noble in aspect as in function. Whatever chance there may be of failure in interior work, rich ornamentation may be given, without any chance of failure, to just that portion of the exterior which will give pleasure to every passer-by, and express the meaning of the building best to the eyes of strangers. There is, I repeat, no chance of serious failure in this external decoration, because your architect has at his command the aid of men, such as worked with the architects of past times. Not only has the art of Gothic sculpture in part remained, though that of Gothic colour has been long lost, but the unselfish—and I regret to say, in part self-sacrficing—zeal of two first-rate sculptors, Mr. Munro and Mr. Woolner, which has already given you a series of noble statues, is still at your disposal to head and systematize the efforts of inferior workmen."

The co-operation of architect and sculptor is a great desideratum:—

"I believe that the elevation of all arts in England to their true dignity, depends principally on our recovering that unity of purpose in sculptors and architects, which characterized the designers of all great Christian buildings. Sculpture, separated from archi-

tecture, always degenerates into effeminacies and conceits; architecture, stripped of sculpture, is at best a convenient arrangement of dead walls; associated, they not only adorn, but reciprocally exalt each other, and give to all the arts of the country in which they thus exist, a correspondent tone of majesty. But I would plead for the enrichment of this doorway by portrait sculpture, not so much even on any of these important grounds, as because it would be the first example in modern English architecture of the real value and right place of commemorative statues. We seem never to know at present where to put such statues. In the midst of the blighted trees of desolate squares, or at the crossing of confused streets, or balanced on the pinnacles of pillars, or riding across the tops of triumphal arches, or blocking up the aisles of cathedrals, in none of these positions, I think, does the portrait statue answer its purpose. It may be a question whether the erection of such statues is honorable to the erectors, but assuredly it is not honourable to the persons whom it pretends to commemorate; nor is it anywise matter of exultation to a man who has deserved well of his country, to reflect that his effigy may one day encumber a crossing, or disfigure a park gate. But there is no man of worth or heart, who would not feel it a high and priceless reward that his statue should be placed where it might remind the youth of England of what had been exemplary in his life, or useful in his labours, and might be regarded with no empty reverence, no fruitless pensiveness, but with the emulative, eager, unstinted passionateness of honour, which youth pays to the dead leaders of the cause it loves, or discoverers of the light by which it lives. To be buried under weight of marble, or with splendour of ceremonial, is still no more than burial; but to be remembered daily, with profitable tenderness, by the activest intelligences of the nation we have served, and to have power granted even to the shadows of the poor features, sunk into dust, still to warn, to animate, to command, as the father's brow rules and exalts the toil of his children. This is not burial, but immortality."

Mr. Ruskin thus sums up the design of the Gothic Revivalists. To make Art expressive rather than curious—fixed rather than portable—publicly beneficial rather than privately engrossed—to convey truthful information of form and promote intelligence among the workmen, has been attempted and carried out in the building. The University, we understand, has not been so parsimonious as Dr. Acland would have us believe, 60,000*l.*, and not 30,000*l.*, having been actually spent on this work. May it speed!

ARTICLE XXII.—*American Association for the Advancement of Science.*

This body held its annual meeting at Springfield, Mass., under the presidency of Dr. Alexander, during the week commencing August 3rd. There was a good attendance, and many interesting and important papers were read; the whole number registered being 108. On Tuesday the 9th, after having chosen Dr. Isaac Lea of Philadelphia to be president, and Dr. B. A. Gould, jr., of Boston, to be vice president for the next year, the association adjourned to meet at Newport, Rhode Island, on the 1st of August, 1860.

It is chiefly from the reports of the meeting published in the *Springfield Republican*, that we extract the following abstracts of several papers, which may prove interesting to our readers.

METEOROLOGY.

The first paper was by Professor Henry of the Smithsonian Institute, on Meteorology. He said that extensive operations had been made in Europe and in this country, by the British admiralty, the French government, the States of New York and Pennsylvania, and by the Smithsonian Institute. The Institute had purchased many hundred instruments which had been distributed over the country, but only a series of observations extending over many years could be of value. Prof. Coffin of Lafayette College had been especially employed by the Institution: he was abundantly qualified to execute the work. The labors performed had been immense, and an idea of what progress had been made would be given. There are 350 observers in the United States who make observations three times a day. To arrive at satisfactory results the observations must also be carried on at sea. This would be done eventually, especially if the public should demand it. It was a science which required time. It was impossible, he said, to make any advance in science if it had no hypothesis. We could collect facts, but to use them we must have a place. In studying nature, we soon learn to reject what is not true and preserve what is true.

He proceeded to give some general views of meteorology. The general idea of the motion of the atmosphere was from Hadley. The moving power in meteoric changes was the sun. It wa, originally supposed that the currents of air flowed from the equator to the

poles, but that could not be true; on account of the convergence of the meridians, there was not room for the air at the poles. There were middle systems, of intermediate currents of air. But these points were not fully established. There were exceptions in the general action which could be determined in their general bearings only by long observation.

One cause of the fitful disturbances of the atmosphere was the conversion of water into vapor. During a single shower an amount of water fell upon the Smithsonian Institute building equal to 20,000 horse-power an hour; that is to say the heat necessary to evaporate it would be equal to that required for working an engine of twenty thousand horse-power one hour. Another cause of disturbance was the motion of the earth itself upon its axis. In illustration, diagrams were given showing that the currents of air moved in circles,—that the same quantity of air that moved north must come from the north, of course not in the same track. Observations made tended to show a series of currents completely around the earth, north and south of the equator, also in the temperate latitudes, and in the Arctic circles. The calms at the equator, it was shown, was caused by the upward currents of the air,—currents coming from the north and south and rising over the equator, under the influence of heat.

In regard to the meteorology of our own continent, it was shown that there were four circles,—two in the Atlantic, one of which the Gulf Stream complete its circle once in three years, one in the Southern Atlantic, one in the Northern Pacific, and one in the Southern Pacific. These are sub-divided into minor currents. It is found that the cold Arctic current setting south from the coast of Labrador, passes through the Gulf of St. Lawrence, while the ice which comes down sets eastward towards Europe. Between these there is produced the deposition of vapor or fog on the banks of New foundland.

He had been assured by Mr. Wise, the æronaut, that out of 200 ascensions, he had always been enabled to move east on reaching an upper stratum of air. He (Prof. H.) therefore did not think it impossible that an aerial voyage could be made to Europe. Success would greatly depend upon the ability to make the balloon air-tight. If kept in the upper strata, it might succeed, although it was not certain there was not a reverse current in mid ocean. In the lower strata there were irregularities which must be avoided. The balloon he considered as an important means of

meteorological observation; by it, electrical phenomena and the formation of clouds could be observed. The reason why the English meteorologists had failed to make any satisfactory observations, was because they lived on the western side of a great continent, with no opportunity to make observations west of them, while we lived on the eastern side of a great continent, with telegraph lines extending inland thousands of miles. The formation of hail, thunder gusts, tornadoes, and other phenomena, were explained in a clear manner, which was listened to with intense interest and frequent applause.

He gave an account of the method of observation pursued each day at the Smithsonian Institute. They have a map of the United States hung upon a board, with pins stuck through it at the points where the observers of the institute are stationed. The Institute has daily reports by telegraph from many of these points. Each morning an assistant hangs a cord on the pins to indicate the state of the weather—black if raining, green if snowing, brown if cloudy, and white if fair. All storms travel east, and thus they are enabled to predict with great certainty the condition of the weather twelve hours in advance.

Meteorology as connected with agriculture, was then considered. It was shown that the fertility of the soil of the United States was owing to the currents from the Mexican Gulf and the Pacific; and it was shown that the climate of the 100th meridian must forever be unfruitful, unless trees should be planted, which might modify it somewhat.

CORRELATION OF PHYSICAL AND CHEMICAL FORCES.

Professor Joseph Le Conte, of South Carolina, read one of the ablest papers of the session on the above subject. The fact that matter is constantly changing its form, and is also indestructable, it universally admitted. Both these axioms hold good with regard to force. "The same absolute of force exists in the universe at all times and forever. The mutual convertibility of the various forms of force, is called the correlation of forces; and the unvariability of the absolute amount in the midst of changes shows the conservation of force."

There are four planes of material existence, which may be regarded as being raised one above another. The first and lowest is the plane of elementary existence, the second the plane of chemical compounds or mineral kingdom, the third the plane of vegetable

existence, and the fourth animal existence. Now it is apparently impossible for any known force in nature to raise matter through all these grades at once. On the contrary, there is a special force adapted for the elevation of matter from each plane to the one above. It is the special function of chemical affinity to raise matter from plane one to plane two. All the changes too which take place upon plane two by the mutual reaction of bodies situated upon that plane, are under the guidance and control of this force. It is the special prerogative of the force of vegetable life, to lift matter from two to three, or from the condition of mineral to the higher condition of vegetable matter. All the changes which take place upon this plane, the laws of which constitute vegetable physiology, are under the guidance of this force. Finally the force of animal life, and that alone, enjoys the privilege of lifting matter still higher into the fourth plane, i. e. the plane of animal existence. No force in nature can lift from one to three, or from two to four. Plants cannot feed entirely upon elementary matter, nor can animals feed upon mineral matter. The reason of this will be seen in the sequel. Thus it seems that after matter is raised from the elementary to the mineral condition, it requires an additional force of another and peculiar kind to raise it into the vegetable kingdom, and again another accession of force to raise it into the animal kingdom. Thus these kingdoms are truly represented as successive planes raised one above the other thus: 1, elements; 2, mineral kingdom; 3, vegetable kingdom; 4, animal kingdom.

In the same manner as matter may be arranged in several distinct and graduated kingdoms, it seems to me the forces of nature may be properly divided into distinct groups arranged in a similar manner one above the other. These are the physical, the chemical and the vital forces. And as in the case of matter, so in the case of force it is impossible to pass directly from the lowest to the highest group without passing through the intermediate group. The conversion of physical into vital force seems impossible without passing through the intermediate condition of chemical force

The argument of Mr. Le Conte went over wide ground and discussed the de- composition and re-formation of tissues and cells in plants—the atomic changes—the conservative forces, showing that vital is only transferred to physical force. In conclusion he asked; "If this is so, is it not possible that physical forces may generate

organisms *de novo?* Do not the views presented above support the doctrines of equivocal generation and the original creation of species by physical force? I answer that the question of the origination of species is left exactly where it was found and where it must always remain, viz., utterly beyond the limits of human science. But although we can never hope by the light of science to know how organism originated, still all that we do know of the laws of the organic and inorganic world seems to negative the idea that physical or chemical forces acting upon inorganic matter can produce them. It is true that vital force is transformed to physical force, but the necessary medium of this transformation is an organized fabric; the necessary condition of the existence of vital force is therefore the previous existence of an organism. As the existence of physical forces cannot even be conceived without the previous existence of matter as its necessary substratum, so the existence of vital force, is inconceivable without the previous existence of an organized structure as its necessary substratum. In the words of Dr. Carpenter: 'It is the speciality of the material substratum thus furnishing the medium or instrument of the metamorphosis, which establishes and must ever maintain a well marked boundary line between physical and vital forces. Starting with the abstract notion of force as emanating at once from the divine will, we might say that this force operating through inorganic matter, manifests itself as electricity, magnetism, light heat, chemical affinity and mechanical motion; but that when directed through organized structures, it effects the operations of growth, development and chemico-vital transformations."

FORMATION OF OCEANS AND CONTINENTS.

Prof. Le Conte then gave his views in respect to the formation of continents and oceans. It was an attempt to prove the truth of the theory of Prof. Airy as to the laws governing bodies floating upon fluids, and considered as explaining the phenomena of continents, oceans, and volcanoes, upon the supposition that the inside of the earth is fluid and enclosed by a crust. Prof. Le Conte gave an elaborate explanation illustrated by diagrams of different bodies floating upon water, proving that the under surface of such bodies may be judged of as to their configuration by a simple inspection of their upper surface. "If there is a general rising or depression of the upper surface from the margin towards the middle, we may be absolutely sure

there is a general projection or hollowing of the under surface corresponding; in a word, the general outline of the two surfaces is similar." If the surface of the earth is raised by continents, a corresponding thickness or elevation must be found inside, a swelling inward of the crust; and if the outer surface is depressed as in ocean bottoms, there the inner surface is hollowed out, making the middle of the bottom much thinner than the edges. The speaker from the evidence adduced to prove these general ideas, assumed that the centre of the earth was fluid, that the crust floats upon its surface and is subject to the laws of floating bodies. The laws and conditions under which this crust cooled and its state when solidified were then scientifically explained at length, as tending to confirm the generally accepted theories as to the fluidity of the central mass.

This theory, the speaker remarked, would satisfactorily account for the distribution of volcanoes, if not for the phenomena. He admitted that volcanoes were the most difficult of explanation of all the igneous phenomena in nature, and although gases and vapours are probably one cause of the eruptions, yet he thought few physical geologists would admit the local pressure of gas as the only or even the chief cause. The great general cause, he thought, might be the reaction of the crust upon the interior fluid, and gave his reasons therefor. At any rate the disruption of the crust should take place in the thinnest part as the bottom of the sea, and the next place should be the next weakest part or the margins of the sea, and these are exactly the places where the volcanoes occur. Of 225 active volcanoes mentioned by Humboldt, 155 are situated upon islands in the ocean, and of the remaining 70 almost the whole are situated near the sea-shore, while but very few are found in the interior of continents. This paper as a whole was remarkably clear, logical and conclusive, and presented many points worthy of study.

GYPSUM AND MAGNESIAN ROCKS.

Mr. T. Sterry Hunt, of Montreal, showed that besides those gypsums formed by the alteration of beds of limestone, another class, by far the more important, comprehends those gypsums which have been deposited directly from water. Such may be produced during the evaporation of sea-water; but Mr. H. has recently shown that sulphate of magnesia is decomposed by solution of bicarbonate of lime, giving rise to gypsum, which is first deposited, and a

more soluble bicarbonate of magnesia, which by further evaporation is separated as hydrous carbonate, either alone or mingled with carbonate of lime. When these magnesian precipitates are gently heated under pressure they are changed into magnesite or dolomite. Thus are explained the magnesian rocks associated with gypsums and with rock salt. The action of solutions of bicarbonate of soda may in like manner separate the lime from sea-water and give rise to solution of bicarbonate of magnesia: in this way are formed the magnesian limestones which are not associated with gypsum. The intervention in this process of the waters of alkaline metalliferous springs will explain the metalliferous character of many magnesian rocks. The source of the bicarbonate of soda has been the decomposition of feldspathic rocks to form clays and clay slates. The action of this alkaline carbonate upon the lime and magnesia salts of the primitive sea has been the source of limestone and dolomites, as well as of the sea salt which we find in the ocean, at the same time that the intervention of the carbonic acid of the atmosphere which has been through the medium of the soda, fixed in the form of carbonate of lime, has served to purify the air and fit it for the support of higher orders of plants and animals. In this relation between the atmosphere, the argillaceous rocks, the limestones and the salt of the sea, we have a remarkable illustration of the balance of chemical forces in inorganic nature.

FORMATION OF SILICIOUS ROCKS.

Mr. Sterry Hunt then spoke of sediments resulting from the disintegration and chemical decomposition of quartzose, feldspathic and pyroxenic rocks. In these the coarser portions consist of quartz and of feldspar containing potash, while the finer clays have less silica but more alumina, and besides alkalies lime, magnesia and iron, which are rare in the coarser sediments. These latter being more pervious to water, the small portions of soda, lime and magnesia still remaining are removed by lixiviation, while the clays retain these bases. When these different sediments are altered and crystallized we shall have on the one hand granitic or trachytic, and on the other pyroxenic rocks, the two great types recognized in igneous rocks, all of which Mr. regards as derived from the alteration and fusion of sedimentary strata. To the gases and vapors evolved by the fusion of deeply buried strata are to be referred the phenomena of earthquakes

and volcanos. The latter although dependent on the heat of the earth's nucleus, are not directly connected with the central fire.

LITHOLOGY OF VERMONT.

Mr. C. H. Hitchcock read a paper upon the so-called talcose schists of Vermont. The geological surveys of the various states have made known the existence of a broad belt of rocks from Canada to Georgia, consisting of green schists denominated talcose, associated with gneiss. This implies the presence of the mineral talc, which contains a large per cent of magnesia. He would not affirm the conclusion at which he had arrived applied to the whole belt, but that probably the character of the whole was the same—aluminous instead of magnesian. Mr. Sterry Hunt of Montreal had analyzed some of these rocks in their northern extension into Canada, and decided that there was no magnesia present, and that talc was replaced by pyrophyilite or pholerite, and had proposed to call them *nacreous schists*, instead of talcose. The rock was originally clay slate. Mr. Hitchcock offered several analyses of these rocks in Vermont, which were made for him by Mr. G. G. Barker of Boston, whence he concluded that there was no magnesia present, but that they were hydrous silicates of alumina with feldspar. One of the specimens from Pownal, Vt., was interesting as affording the compositon of dsysintribite and of parophite, a mineral found in certain rocks in Canada by Mr. Hunt.

An analysis of a sandstone belonging to the Oneida conglomerate was also given, which went to show that some of the talcose schists were formed from sandstone probably of that age.

THE FLORA OF JAPAN AND NORTHEASTERN AMERICA.

Prof. Asa Gray, gave a theoretical explanation of the identity or similarity existing between the flora of Japan and that of the northeastern part of North America. In the beginning, the speaker said that many plants supposed heretofore to be found only in the northeastern part of North Ameria had lately been found indigenous to Japan, and instanced the poison ivy, the fox grape, choke cherry, sweet cicely and ginseng as examples. Among shrubby plants our poison dog-wood has a prototype in the varnish tree of Japan. Closely allied species generally occur in the same, or contiguous localities, but here are identical species found on opposite sides of the globe, and the question naturally arises, what bearing

have these facts on the theories of the original distribution of species? Three different views have been advanced to explain the distribution of the same plants on the globe. The first supposes them to have originated in many different localities where they now are found. This is the view entertained by Prof. Agassiz, and on this theory these peculiar plants must have originated in two distinct and widely separated districts. The second theory refers the origin of each species, to one place, but allows some of them to have been reproduced in other localities as exceptions to the general law. The third refers each species to one place only as its starting point, though not from one pair, necessarily, unless it be in the case of the higher plants. This was the theory adopted by the speaker, although the facts already given as to the plants found in Japan, at first seemed opposed to such an idea. In explanation of those facts, he said the similarity of climate between Japan and New England would not be sufficient. The plants of western Europe are not like those of Oregon and California, though the climate is. The idea that the seeds have been carried naturally from one country to the other is not satisfactory. He supposed the flora of this country to be older than the fauna; and that it dates back probably to the post-tertiary period. The evidence of this last he based principally on the alleged fact that fossilized specimens of our present flora have been found, and referred to about the time of the drift period; and he then explained at some length his views as to the effect produced on the vegetation by the changes in temperature during the glacial period. Whatever dispute there might be as to this last matter, the fact would not be denied that our present flora appeared soon after that period. In the diluvial epoch the temperature in this latitude must have been much warmer than it now is; the temperate flora of the present day, then also in existence, must have extended much further north, perhaps nearly up to the Artic circle, and probably spread across from one continent to the other. Want of time prevented him from giving his views as to why he adopted the third theory of the origin and distribution of plants rather than the others; he simply wished to-day to give his views in explanation of facts seemingly opposed to it.

DEVONIAN AND CARBONIFEROUS FLORA OF BRITISH AMERICA.

PROF. DAWSON of Montreal gave a summary of results which he had obtained from the study of the land plants preserved in

the Devonian rocks of Gaspé,—the Gaspé sandstones of Sir W. E. Logan's survey. The most remarkable of these remains is a Lycopodiaceous plant, for which he had instituted the new genus *Psilophyton;* it is so preserved in the Gaspé sandstones as to exhibit all its parts in a remarkably perfect manner. Many so-called Devonian fucoids are merely fragments of this plant. The Devonian flora of Canada also includes a conifer named by Prof. D. *Prototaxites Logani*, a *Lepidodendron*, *Nœggerathia*, and *Knorria*, with some other plants not determined. In the collection of Dr. Jackson of Boston, and at Portland, Prof. D., had seen specimens indicating that a similiar flora exists in rocks probably Devonian at Perry, Maine.

The remainder of the paper was occupied with the results of an extensive series of Microscopic observations on the Coal of Nova Scotia, prepared by new methods. A number of beautifully preserved vegetable tissues were described, and the following general conclusions stated. 1st. The mass of the coal is of gymnospermous or cryptogamous origin, principally from sigillaria and calamites, and accumulated by growth *in situ*. 2d. The rate of accumulation of coal must have been very slow. The sigillaria were allied in structure to cycads and conifers, and it is chiefly their bark and woody axes that occur in the coal. In a vertical foot of coal we may have the bark of a hundred successive generations of trees. The climate of the coal-producing eras was equable and moist as in the islands of the southern hemisphere at the present day. The coal forests were dense and covered large plains; as the trees fell they gradually decayed, and a dense vegetation soon covered the whole mass. The growth of sigillaria was more rapid than that of trees of the present day of like size, but their structure proves that they did not spring up in a month or two as some have supposed.

DEVONIAN GRANITES AND TACONIC ROCKS.

Prof. Hitchcock of Amherst then read a short paper giving an account of a deposit of fossiliferous limestone beneath granite and mica slate in Derby, Vt. He wished to call attention to this locality, as he had found something new to him, and leading to different conclusions than those commonly held. This deposit occurs near Lake Memphremagog. He showed by diagrams the granite overlying the limestone, and what was singular, the former dipped down into the latter in veins and there terminated. He

called on Sir William Logan of Montreal for his views on the subject.

The latter said that on the Canada side of the boundary line this limestone had been traced from Memphremagog lake near Derby, to the Gulf of St. Lawrence in Gaspé, a distance of 500 miles. It was well stored with fossils at several places, and appeared to be partly Upper Silurian and partly Devonian. One of the localities of fossils was Memphremagog lake, when the fossils appeared to be allied to Devonian forms. In this neighbourhood there are masses of granite. Bebee's plain bordering on the lake presents an area of thirty-six square miles of granite from which emanate dykes cutting and dislocating the calcareous strata. From this it is evident the granite is newer than the limestone, and therefore may well be found occasionally to overlie it. The granite he considered to be of the same age as that so widely extended in New Hampshire and Maine; it had been traced to New Brunswick, and at Bathurst was found to underlie the coal formation. Its age would thus be Devonian On the west side of the Green Mountain range there was a calcareous area related to the limestones of Rutland, which, from a section he had lately made eastward from Lake Champlain in the neighbourhood of Burlington, he considered to be of the same age as that at Memphremagog.

Mr. J. P. Lesley of Philadelphia, said that since Sir William Logan had informed them, that he had lately been making some investigations in Vermont, he would probably be able to state some opinion in regard to the Taconic rocks.

Sir William Logan replied that having been referred to the black slate outside of Sharp-Shins near Burlington, as an instance of Taconic slates, these he had found lying conformably beneath the magnesian limestones of the same point, and at Apple-tree Point on the outside of this he had found, among similar slates, *Triarthrus Beckii*, a fossil known to belong to the shales of the Lower Silurian series. The magnesian limestone and the black shales beneath, he had traced in the same relation almost without a break, to the Canada boundary. From Quebec he had traced black shales and magnesian limestone, in the same relation to the same point on the boundary line. At Quebec both the shales and the limestone were characterized by rock-marked fossils. The fossils of the shales were those of the Utica slate and Hudson River Group, and he had no doubt that the slates of Sharp-Shins were of the same age.

ON THE LAURENTIAN LIMESTONES.

Sir William Logan exhibited to the section, a map on which was delineated in detail on the scale of an inch to a mile, the distribution of some of the bands of crystaline limestone interstratified with the gneiss of the Laurentian series of rocks on the north side of the Ottawa River, about forty miles above Montreal. This he explained was a continuation of similar work shown at the Montreal meeting of the association. By his recent exploration, two additional bands of limestone had been ascertained to underlie the lowest of those previously examined, the whole of the strata associated with these lower three, including the limestones, being supposed to be about 15000 feet thick. These three bands are separated from one another by gneiss, a large portion of which is porphyroid or coarse-grained, the feldspar being almost wholly orthoclase, whereas, as was stated at the Montreal meeting, calcareous bands above them are largely associated with labradorite. Intercalated with the coarse and massive orthoclase gneiss, were frequent beds, which may be characterized as mica slate, and approaching the calcareous bands are beds of hornblende rock, and quartz rock, these latter, and sometimes bands of nearly pure white orthoclase, when immediately near the limestone or interstratified with it, being very often thickly studded with pink garnets, one of the beds of white and nearly pure quartz rock, which was traced for a mile and a-half, presented a thickness of 1000 feet. No instance of clay slates was met with.

These ttrata are exceedingly corrugated, and the outcrop of the limestone presents a multitude of sharp turns resulting from small plications subordinate to more important synclinal and anticlinal forms, the axes of which appear to run nearly north and south. Some of these axes have now been traced up the Rouge, a tributary of the Ottawa, for a distance of fifty miles in a straight line.

Although the Laurentian series has hitherto been considered azoic, a search for fossils in them has not been neglected. Such search is naturally connected with great difficulties. Any organic remains which may have been entombed in these limestones, would, if they retained their calcareous character, be almost certainly obliterated by crystalization, and it would only be through their replacement by a different mineral substance that there would be a chance of some of the forms being preserved. No such instances had been observed on the investigations of the Rouge and its

vicinity, but from another locality in the Laurentian formation, Mr. John McMullin, one of the explorers of the Geological Survey had obtained specimens well worthy of attention. They consisted of parallel or apparently concentric layers resembling those of the coral *Stromatocerium*, except that they anastomoze at various parts, the layers consist of crystaline pyroxene, while the interstices are filled with crystalized carbonate of lime. These specimens had recalled to recollection others which had been obtained from Dr. Wilson of Perth some years ago, and had not then been regarded with sufficient attention. In these similar forms are composed of green serpentine, concretionary while the interstices are filled with white dolomite. If it be supposed that both are the result of mere unaided mineral arrangement, it would seem strange that identical forms should result from such different minerals in places so far apart. If the specimens had been obtained from the altered rocks of the Lower Silurian series, there would have been little hesitation in pronouncing them to be fossils. The resemblance of these forms to *Stromatocerium* from the Birdseye limestone, when the coral has been replaced by concretionary silica is very striking. In the pyroxenic specimens, the pyroxene and the carbonate of lime being both white, the forms although weathered into strong relief on the surface, are not perceptible in fiesh fractures until the fragments are subjected to an acid, the application of which shows the structure running throughou thet mass. Several specimens of these supposed fossils were exhibited to the Section.

ART. XXIII.—*Description of a new Genus of Brachiopoda, and on the Genus Cyrtodonta.* By E. Billings.

(From Report of Geological Survey, 1858 and '59, unpublished.)

Genus Camerella, Billings.

Generic characters.—Family Rhynconellidæ; ventral valve, with a small triangular chamber beneath the beak, supported by a short mesial septum as in *Pentamerus.* Dorsal valve, with a single mesial septum and two short lamellæ for the support of the oral appendages, as in *Rhynconella.*

Camerella Volborthii, Billings.

Description.—Small, nearly globular; ventral valve, with a broad mesial sinus which deeply indents the opposite valve, but

becomes obsolete at about half the distance to the beak; a corresponding elevation on the dorsal valve. On each side of the mesial sinus and elevation there are three short plications; there also three on the elevation of the dorsal valve, and two in the sinus of the ventral valve; beak of ventral valve short, incurved at the point, but elevated above and not in contact with the umbo of the dorsal valve; the beak of the latter strongly incurved. Length, five lines; width, four lines and a half; depth of both valves, four lines.

Locality and formation.—Black River Limestone, Pauquette's Rapids.

CAMERELLA PANDERI, Billings.

Description.—In this species some of the specimens are nearly circular, in others the length is one-fourth greater than the width; both valves evenly convex; a broad, obscure sinus in the front of the ventral valve, which extends one-fourth the distance to the beak; a corresponding elevation in the dorsal valve. The front of each valve is also marked with several very obscure indentations, of which the sinus has one or two, and the mesial elevation of the dorsal valve two or three. Beak of ventral valve short, incurved, but not in contact with the umbo of the other valve. Beak of dorsal valve strongly incurved. Length, four or five lines; width, equal to or a little less than the length.

Locality and formation.—Black River Limestone, Pauquette's Rapids.

CAMERELLA LONGIROSTRA, Billings.

Description.—This little species has much the form of *C. Panderi*, except that the beak of the ventral valve is very much elongated and erect, or only slightly curved at the point. There are no plications in the front of the valves, but only a single smooth-rounded mesial fold and sinus. Length of ventral valve, four lines and a half, width three lines; length of dorsal valve, three lines and a half; length of beak of ventral valve, one line. These measurements refer to a single specimen, the only perfect one collected. It may be hereafter ascertained that the species is much longer.

Locality and formation.—Chazy, Mingan Islands. Collected by Sir W. E. Logan.

Genus CYRTODONTA, Billings.

In this genus, including its sub-genus *Vanuxemia*, the number of teeth is variable. There are from two to eight anterior, and from two to four posterior teeth. When I described the genus I figured several species with three anterior teeth, and stated that *C. rugosa* appeared to have four, while *V. Bayfieldii* was represented with seven. It would appear also that Professor Hall has observed a species with five, as he has stated in a recent publication that the genus has three, four or five anterior teeth. During the present year, Mr. Bell, of the Geological Survey, has collected many specimens, apparently of several species, which exhibited two, three, four, six and in one apparently eight anterior teeth. It is quite clear, therefore, that the number is variable, as stated by me in my description of the sub-genus. In consequence of these discoveries, the only distinctive character of the sub-genus *Vanuxemia* is the terminal position of the beaks, and it may be necessary to suppress it altogether.

MISCELLANEOUS.

Lower Carboniferous Coal-Measures of British America. A paper by Principal Dawson giving an account of the present state of knowledge respecting these interesting beds and their fossils, was read before the Geological Society of London, at its meeting of April 28th. The following is from Abstracts of Proceedings of the Society.

"Deposits indicating the existence of the Coal-flora and its associated freshwater fauna at the beginning of the Carboniferous period, are well developed in Nova Scotia and New Brunswick, with a clearness and fullness of detail capable of throwing much light on the dawn of the terrestrial conditions of the Coal-period, and on the relations of these lower beds to the true coal measures. This lower series comprises shales and sandstones (destitute of marine remains, but containing fossil plants, fishes, entomostraca worm-tracks, ripple and rain marks, sun cracks, reptilian foot-prints, and erect trees) and great overlying marine limestones and gypsums. These are distinct from the true coal-measures by their position, mineral character, and fossil remains. In the western part of Nova Scotia (Horton, Windsor, &c.) the true (or Upper and Middle) Coal-measures are not developed; and here the Lower Carboniferous marine deposits attain their greatest

thickness. The lower coal-measures (or Lower Carboniferous freshwater or estuarine deposits) have here a thickness of about 600 feet. These beds are traceable as far as the Shubenacadie and Stewiacke Rivers. They outcrop also on the south side of the Cobequid Mountains, where the marine portion is very thin, owing perhaps to the fact of these mountains having been land in the coal-period.

Along the northern side of the Cobequid Range, the upper and middle coal-measures and the marine portion of the Lower Carboniferous series are of great thickness. The lower beds are absent here, though brought up on the northern side of the coaltrough of Cumberland, where in New Brunswick (Peticodiac River, &c.), they are remarkable for their highly bituminous composition, their well-preserved fish-remains, and the almost entire absence of plants. To the north, at the Bay of Chaleurs, the great calcareous conglomerate, with sandstone and shale, 2766 feet thick, described by Logan, and containing a few plant-remains, probably represent the Lower Coal-measures of Nova Scotia. In eastern Nova Scotia and Cape Breton the Middle Coal measures are found at Caribou Cove and elsewhere; the marine limestones and gypsums, and the underlying sandstones and shales, are seen at Plaister Cove; also at Right's River, and St. Mary's River.

In Nova Scotia these older coal-measures, as compared with the true coal-measures, are more calcareous, more rich in remains of fishes, and have fewer vegetable remains, and indications of terrestrial surfaces. They occur generally along the margins of the coal-areas, near their old shores; and, as might be expected under such circumstances, they are associated with or replaced by beds of conglomerate derived from the neighbouring highlands of Devonian or Silurian rocks. When the conglomerates are absent, alternations of sandstones with sandy and calcareous shales occur, with frequent changes in character of the organic remains. The general aspect being that of muddy estuarine deposits, accumulated very slowly, and discoloured by decaying organic substances. The supply of sediment, and the growth and preservation of vegetable matter, appear to have been generally on a smaller scale in this early carboniferous period than subsequently. In those districts where the true coal-measures are least developed the lower series is most important; showing that the physical and vital conditions of the Coal-measures originated as early as those of the Moun-

tain-limestone; and that locally these conditions may have been contemporaneous throughout the whole period; but that in some localities the estuary and swamp deposits first formed were completely submerged and covered by oceanic deposits, whilst in others early marine beds were elevated and subjected to the conditions of gradual subsidence and vegetable growth indicated in the great coal-measures of the South Joggins, Pictou, and Sidney.

In Nova Scotia the Lower Coal-measures are characterized by a great preponderance of *Lepidodendra* (especially *L. elegans*) and *Poacites*, with few ferns or *Sigillariæ*. The middle Coal-measures are rich in *Sigillariæ* and Ferns, as well as *Lepidodendra*. The Upper Coal-measures especially abound in Conifers, Calamites, and Ferns. *Palæoniscus*, *Gyrolepis* or *Acrolepis*, *Centrodus*, *Rhizodus*, and *Ctenacanthus* are the chief fossil fishes of this Lower Carboniferous series. Unio-like shells are nearly the only remains of Molluscs.

Donations to the Library of the Natural History Society of Montreal. 1858 *and* 1859.

Translated Report of a recent Meeting of a Philosophical Society in Germany; by Mr. Gordon.

Description of New Fossils from Coal Measures of Missouri and Kansas; by T. Shumard and G. C. Swallow.

Pamphlet on Grape Culture in Missouri; by G. C. Swallow, Esq.

A set of Presidents' Anniversary Addresses, delivered before the Geological Society of London from 1846 to 1857 (the years 1847 and 1851 excepted); from Dr. Gibb, London.

Proceedings of the Essex (U. S.) Institute, Vol. II., Part I., 1856 to 1857; from the Institute.

Reply to the Statement of the Trustees of the Dudley University, U. S.; from Benjamin Aythorp Gould, Jr.

Relations des Jésuits; from the Government of Canada.

The Journal of Education; The Canada Official Gazette; Journals of Legislative Assembly; Medical Chronicle; The Statutes of Canada.

Donations to the Museum of the Natural History Society of Montreal. 1858 *and* 1859.

Large Egg; from Mr. Ewing.

Specimen of a Neuropterous Insect; by Charles Sharpley, Esq.

The following from Alex. Bell, of Euphemia, through Edward Little, of Newburg, C. W.:—

1. A Wart taken from the root of a soft-maple tree (*Acer. dasycarpum*) fully 26 feet from the living trunk, the root to which it was attached not exceeding one inch in diameter at its junction in either end. 1856.

2. An Arrow nearly one yard in length, one of a full quiver of fifty from Upper California, now in possession of a gentleman who, after being pierced with two of them, despatched the Indian and brought the bow and arrow home. The quiver is made of tanned deerskin, with the hair on. The arrow is made of two different kinds of wood and spliced very neatly; it is also barbed with three feathers. The stone head is remarkably sharp and neatly made.

3. An Oak Deer-bleat, given to the donor by the Indian Shauriabee in 1846, and stated by him to be his own manufacture.

4. A Stone Arrow-head 1½ inches long, found ten feet under ground on Lot 21, Euphemia, C. W., shewing a striking analogy between the Californian and Canadian weapon.

5. An Oval Stone Hatchet about 4 inches long by 2½ broad, ¾ inch thick, well polished and perforated across its breadth, the aperture half an inch in width. The stone is a very jasperry slate, transversely marked with natural lines. This instrument was obtained in 1854 below the surface of the ground on the margin of the River Sydenham, Lot 12, First Concession, Brooke, C. W.

6. A Horse's Tooth. (For particulars see page 317 of the *Naturalist* for August, 1858.)

7. A piece of fossiliferous limestone from Newburg, C. W.

A true specimen of *Datura Wrightii Metallides;* from William Lunn, Esq.

Snout of a Sword-fish; from Captain Lafontaine.

A Thermometer; from Dr. Gibb, London.

Two portions of Strata from bed of the St. Lawrence; from Captain Dutton.

Two specimens of *Coronula Diadema* from whales in the Gulf of St. Lawrence; from Principal Dawson.

Twenty-one Chinese Tiles; from Dr. Gibb, London.

Box of Ores; from —— Wilgress, Esq.

A Box of Specimens from Pompeii; from Dr. W. Jones.

A Belt-plate of the Royal 60th Regiment; from ditto.

The Rattle of a Rattlesnake; from ditto.

Bamboo or Cane-stick, with curious knotted head (from the Mauritius); from ditto.

Fossil Plants from Devonian Rocks of Gaspé; from Principal Dawson, President of the Society.

Antelope Furcifer, from the plains of the Saskatchewan; from Geo. Barnston, Esq.

Tetrao Richardsoni, male and female, from the Rocky Mountains, lat. 65 degrees N.; from ditto.

Embryo Salmon; from James Ferrier, Jr., Esq.

A Concretion from the Caen stone used in the construction of the new English Cathedral; from Mr. Hutchinson, builder.

A Systematic List of Coleoptera found in the Vicinity of Montreal. By W. S. M. D'Urbain.

The following list, being the result of hardly two seasons' collecting, contains only a small portion of the *Coleoptera* to be found in the neighbourhood of Montreal, but is nevertheless offered as a contribution to the Entomology of Canada, in the belief that it will be useful in ascertaining the geographical distribution of the species enumerated, nearly all of which have been determined by the eminent coleopterist, Dr. J. L. Leconte of Philadelphia, to whom I here beg to return my sincere thanks for his kindness in naming a large number of specimens for me.

Geodephaga.

1. Family *Cicindelidæ*, Kirby.

1. Cicindela, *Linn.* (See Trans. Amer. Phil. Soc., Vol. XI., new series, p. 27.)

   C. sexguttata, *Fabr.* Common, May and June.

   C. purpurea, *Oliv.* Extremely abundant on sandy places from April to August; several remarkable varieties occur.

   C. vulgaris, *Say.* (obliquata, *Dej.*) Very abundant, with the preceding species.

   C. duodecim-guttata, *Dej.* (proteus, *Kirby.*) In the same places, but not so numerous as the two last species, May.

   C. Baltimorensis, *Herbst.* (repanda, *Dej.*) Rather scarce, May to July.

2. Fam. *Carabidæ*, Leach.

1. Sub-fam. *Brachinides*, Westw.

1. Lebia, *Latr.*

   L. tricolor, *Say.* One specimen taken on the Mountain in October.

   L. fuscata, *Dej.* Rare, by sweeping herbage on the Mountain in June.

   L. axillaris, *Dej.* Rare, by sweeping herbage on the Mountain in June.

   L. viridis, *Say.* Rare, on the Mountain in October.

   L. pumila, *Dej.* Abundant on flowers of *Solidago* in August.

2. Cymindis, *Latr.* (Tarus, *Clairville.*)

   C. pilosa, *Say.* Rare, under bark of dead stumps on the Mountain.

   C. reflexa, *Lec.* (marginata, *Kirby?*) Common under stones, bark of dead stumps, &c., on the Mountain, May.

3. Brachinus, *Weber.*
   (*Several species, not determined.*) Common, under stones.

2. Sub-fam. *Scaritides,* Westw.

4. Dyschirius, *Bon.* (See Proc. Acad. Nat. Sci. Phila., Vol. IX. p. 75.)
   D. globulosus, *Putz.* Under stones on the Mountain, May.

3. Sub-fam. *Harpalides,* Westw.

5. Patrobus, *Dej.*
   P. longicornis, *Say.* Under stones, Montreal and Belœil Mountains, May and June.
6. Platynus, *Bon.* (Agonum and Anchomenus, *Bon.*) (See Proc. Acad. Nat. Sci. Phila., Vol. VII. p. 40.)
   P. sinuatus, *Dej.* Abundant under bark of stumps, swamp near Mile-end road, September.
   P. melanarius, *Dej.* Under stones, sides of the Mountain, May.
   P. Harrisii, *Lec.* One specimen taken under a stone N.E. side of the Mountain, April.
   P. atratus, *Lec.* One specimen taken with the last species.
   P. cupripennis, *Say.* Abundant under stones, &c., everywhere.
   P. obsoletus, *Say.* Very numerous in the old Museum of the Nat. Hist. Soc., Little St. James St., May to August, 1857; flies to light at night.
   P. stigmosus, *Lec.* Not common, under stones.
7. Pœcilus, *Bon.* (See Journ. Acad. Nat. Sci. Phila., Vol. II. new series, p. 253.)
   P. lucublandus, *Dej.* Extremely abundant under stones every where, especially in early spring.
8. Pterostichus, *Bon.* Feronia, *Latr.* (See Journ. Acad. Nat. Sci. Phila., Vol. II., new series, p. 234.)
   P. mutus, *Say.* Abundant under stones, Montreal and Belœil Mountains, May and October.
   P. erythropus, *Dej.* Under stones on the Mountain, May.
   P. adjunctus, *Lec.* Under stones, sides of the Mountain, May.
   P. mandibularis? *Kirby.* Under stones, sides of the Mountain.
9. Amara, *Latr.* (See Proc. Acad. Nat. Sci. Phila., Vol. VII., p. 346.)
   A. angustata, *Say.* One specimen taken by sweeping herbage, sides of the Mountain, June.
   A. impuncticollis, *Say.* Under stones.
   A. interstitialis, *Dej.* (inæqualis, *Kirby.*) Not uncommon in spring.
   A. obesa, *Say.* Not common, under stones.
10. Agonoderus, *Dej.*
   A. pallipes, *Dej.* Not uncommon under stones on the Mountain slopes.
11. Anisodactylus, *Dej.*
   A. Baltimorensis, *Say.* Common under stones, &c., Montreal and Laprairie.
   A. Harrisii, *Lec.* (agricola, *fide Harris.*) Not common, under stones.

12. Harpalus, *Latr.*

H. Pensylvanicus, *Geer.* (bicolor, *Fabr.*) Abundant under stones. In vast numbers at dusk running over the fields near Laprairie, in September.

H. viridiæneus, *Beauv.* Abundant under stones, Montreal and Sorel.

H. herbivagus, Say. In great abundance under stones, &c., Montreal, Laprairie, Belœil Mountain, and Sorel, April to October.

13. Bradycellus, *Erich.* (Geobænus, *Lec.*)

B. rupestris, *Say.* (Trechus flavipes, *Kirby.*) Common under stones, sides of the Mountain, and at Sorel under dry cow-dung.

14. Stenolophus, *Dej.*

S. conjunctus, *Say.* By sweeping herbage on the Mountain in June; common under stones, Belœil Mountain, in May.

S. inops, *Lec.* One specimen taken under a stone, Belœil Mountain, May.

15. Chlænius, *Bon.* (See Proc. Acad. Nat. Sci. Phila., Vol. VIII. p. 25.)

C. sericeus, *Forst.* Extremely abundant under stones everywhere.

C. chlorophanus, *Dej.* Common under stones, shores of islands above Lachine.

C. tricolor, *Dej.* Abundant under stones.

C. Pensylvanicus, *Say.* (vicinus, *Dej.*) Not so common as the last species.

C. circumcinctus, *Say.* Rare.

C. impunctifrons, *Say.* Rare, Belœil Mountain.

C. tomentosus, *Say.* Logan's farm, June.

4. Sub-fam. *Carabides*, Westw.

16. Carabus, *Linn.*

C. serratus, *Say.* Under stones; most numerous at Sorel.

17. Calasoma, *Weber.*

C. calidum, *Fabr.* Very abundant everywhere.

18. Elaphrus, *Fabr.*

E. Californicus, *Mann.* (var. punctatissimus, *Lec.*) Rare.

5. Sub-fam. *Bembidiides*, Westw.

(See Proc. Acad. Nat. Sci. Phila., Vol. IX., p. 2.)

19. Bembidium, *Latr.* (Ochthedromus, *Lec.*)

B. lucidum, *Lec.* Abundant under stones and in damp yards, May and June.

B. patruelis, *Dej.* Taken by sweeping herbage, Logan's farm, June.

B. versicolor, *Lec.* (variegatum, *Kirby.*) Taken by sweeping, Logan's farm, June.

B. rupestre, *Dej.* One specimen taken in the yard of the old Nat. Hist. Soc. Museum, Little St. James Street, June 1857.

20. Tachys, *Knoch.*

T. inornatus, *Say.* Numerous under bark of a dead pine on the Mountain, May; and Mile-end road, September, 1857.

HYDRADEPHAGA.

1. Fam. *Dytiscidæ*, Leach.

1. Sub-fam. *Dytiscinæ*.

1. Dytiscus, *Linn.*
   D. fasciventris, *Say.* (Carolinus, *Aubé.*) Rare, ditches on the Lachine Railway, April.
2. Acilius, Leach.
   A. fraternus, *Harris.* Extremely numerous in small pools on the sandy common between St. Catherine and Sherbrooke Streets May.

2. Sub-fam. *Colymbetinæ*.

3. Colymbetes, *Clairville.*
   C. triseriatus, *Kirby.* One specimen taken in a pond near Mile-end toll-bar, May 7th, 1857.
   C. binotatus, *Harris.* In a pond on the common at Laprairie, May 13th, 1857.
4. Ilybius, *Erichs.*
   I. biguttulus, *Germ.* In a small pool in a field at the head of St. Denis Street, August 27, 1857.
5. Agabus, *Leach.*
   A. striatus? *Say.* In ponds, June.
   A. (*not named.*) In a running stream on the common between St. Catherine and Sherbrooke Streets, May 7th, 1857.
6. Laccophilus, *Leach.*
   L. maculosus, *Say.* Abundant in streams and ponds, Montreal and St. Hilaire.

3. Sub-fam. *Hydroporinæ*.

(See Proc. Acad. Nat. Sci. Phila., Vol. VII., p. 290.)

7. Hydroporus, *Clairville.*
   H. similis, *Kirby.* Numerous in a pond at the head of St. Denis Street, April 1857.
   H. modestus, *Aubé.* In small ponds between St. Catherine and Sherbrooke Streets West, beginning of May.
   H. nanus, *Aubé.* Very abundant in ponds between St. Catherine and Sherbrooke Streets West, and at St. Hilaire, May.

Sub-fam. *Haliplinæ*.

8. Haliplus, *Latr.*
   H. immaculaticollis, *Harris.* Stream on Logan's farm, October.
9. Cnemidotus, *Illig.*
   C. duodecim-punctatus, *Say.* Very abundant in a stream on Logan's farm, October.

2. Fam. *Gyrinidæ*, Leach.

1. Gyrinus, *Geoff.*
   G. lateralis, *Aubé.* Pools on the common between St. Catherine and Sherbrooke Streets West, May.
   G. (*not determined.*) Pools on the common between St. Catherine and Sherbrooke Streets West, May.
   G. (*not named.*) Pools and streams, May to October.

2. Dineutes, *Brulle.*
   D. (*not determined.*) Abundant in the St. Lawrence, Lachine, &c.

PHILHYDRIDA.

Fam. *Helophoridæ*, Leach.

1. Helophorus, *Fabr.* (See Proc. Acad. Nat. Sci. Phila., Vol. VII. p. 357.)
   H. lacustris, *Lec.* In small pools, Montreal and Laprairie, May and August.
   H. lineatus, *Say.* In the streams on Logan's farm, October.

Fam. *Hydrophilidæ*, Leach.

(See Proc. Acad. Nat. Sci. Phila., Vol. VII. p. 356.)

1. Berosus, *Leach.*
   B. striatus, *Say.* Abundant in streams and ponds, Montreal and St. Hilaire, May.
   B. infuscatus, *Lec.* One specimen taken in a pool near Sherbrooke Street, May 4th, 1857.
2. Hydrophilus, *Geoff.*
   H. glaber, *Hbst.* Common in running streams, June to October.
3. Hydrocharis, *West.*
   H. obtusatis, *Say.* Not common, pools between St. Catherine and Sherbrooke Streets West, May.
4. Hydrobius, *Leach.*
   H. regularis, *Lec.* Ponds, Montreal and St. Hilaire, May.
5. Laccobius, *Erich.*
   L. agilis, *Randall.* Pools on the common between St. Catherine and Sherbrooke Streets West, end of May, 1857.

Fam. *Sphæridiidæ*, Leach.

1. Cercyon, *Leach.* (See Proc. Acad. Nat. Sci. Phila., Vol. VII. p. 374.)
   C. flavipes, *Lec.* In a decayed cabbage near McTavish House, May 11th, 1857.
   C. centrimaculatum, *Lec.* By sweeping grass, Logan's farm, August and October.

NECROPHAGA.

1. Fam. *Silphidæ*, Leach.

(See Proc. Acad. Nat. Sci. Phila., Vol. VI. p. 274.)

1. Necrophorus, *Fabr.*
   N. orbicollis, *Say.* Rare.
   N. velutinus, *Fabr.* Common.
2. Silpha, *Linn.*
   S. surinamensis, *Latr.* Abundant under dead animals.
   S. Lapponica, *Hbst.* Abundant under dead animals.
   S. marginalis, *Fabr.* Abundant under dead animals.
   S. Americana, *Linn.* Not common.
   S. inæqualis, *Fabr.* Rarely met with. Several pairs taken under a small dead snake in 1850.

BRACHELYTRA.

Fam. *Staphylinidæ*, Leach.

1. Sub-fam. *Aleocharinæ*.

1. Falagria, *Leach*.
   F. dissecta, *Erichs*. Abundant in cow-dung, Montreal and Sorel.
2. Homalota, *Mann*.
   (*Five undetermined species.*) Taken abundantly under stones, bark of trees, stumps, &c., and by sweeping grass.
3. Aleochara, *Grav*.
   A. bimaculata, *Grav*. In cow-dung, abundant.
   A. (*not determined.*) By sweeping grass, Logan's farm, June 1857.
4. Tachyporus, *Grav*.
   T. acaudus, *Say*. Swept from herbage on the Mountain, June.
   T. jocosus, *Say*. Under stones, June.

2. Sub-fam. *Tachininæ*.

5. Tachinus, *Grav*.
   T. ventriculus, *Say*. Abundant under bark of dead pines and under stones on the Mountain.
   T. (*not named.*) In cow-dung on the Mountain, September 1856.
6. Othius, *Leach*.
   O. (*not determined.*) Under bark of a maple stump on the Mountain, May 20th, 1857.

3. Sub-fam. *Staphylininæ*.

7. Heterothops, *Kirby*.
   H. (*not determined.*) August, 1856.
8. Xantholinus, *Dahl*.
   X. obsidianus, *Mels*. In cow-dung.
   X. cephalus, *Say*. Under bark of stumps. Montreal and Sorel.
9. Staphylinus, *Linn*. (Creophilus, *Kirby*.)
   S. villosus, *Grav*. Abundant under dead animals everywhere.
   S. cingulatis, *Grav*. Not very common, under dead animals.
   S. cinnamopterus, *Grav*. Rare under stones, in back yards, &c. in the city.
   S. violaceus, *Grav*. Abundant under stones and bark of decayed stumps on the Mountain.
10. Philonthius, *Leach*.
    P. æneus, *Grav*. Abundant under stones, sides of the Mountain.
    P. Harrisii, *Mels*. One specimen taken under a stone on the Mountain, May 19th, 1857.
    (*Several other species not determined.*)
11. Quedius, *Leach*.
    Q. (*not determined.*) Under stones, fields near Mile-end road, and in back yards.
12. Lathrobium, *Grav*.
    L. puncticolle, *Kirby*. In cow-dung.
    L. (*not named.*) Abundant under stones, Mile-end road, and at Laprairie, in May.

13. Cryptobium, *Mann.*
  C. pallipes, *Grav.* Under stones, Mile-end road, May 1857.

4. Sub-fam. *Steninæ.*

14. Lithocaris, *Erich.*
  L. confluens, *Say.* Common in cow-dung on the Mountain, Oct.
15. Sunius, *Leach.*
  S. discopunctatus, *Say.* Common under stones in fields near Mile-end road, May.
16. Pœderus, *Fabr.*
  P. littorarius, *Grav.* Common under stones in fields near Mile-end road, May.
17. Stenus, *Latr.*
  S. flavicornis, *Erich.* By sweeping herbage, sides of the Mountain June.

5. Sub-fam. *Oxytelinæ.*

18. Platystethus, *Mann.*
  P. Americanus, *Erich.* Abundant under dead animals, and by sweeping herbage, August.
19. Oxytelus, *Grav.*
  O. sculptus, *Grav.* One specimen taken under a stone, Simpson Street, April 1857.
  O. Pensylvanicus, *Erichs.* In cow-dung.

HELOCERA.

1. Fam. *Histeridæ*, Leach.

(See Proc. Acad. Nat. Sci. Phila., Vol. VI. p. 37.)

1. Platysoma, *Leach.*
  P. Lecontei, *Marseul.* Under bark of trees, Montreal and Belœil Mountains.
2. Hister, *Linn.*
  H. abbreviatus, *Fab.* Common under dead animals, and in horse-dung.
  H. perplexus, *Lec.* (?) Under stones, sides of the Mountain.
  H. Americanus, *Payk.* Under stones and in cow-dung, Montreal and Sorel, May.
3. Saprinus, *Erich.*
  S. assimilis, *Payk.* Under dead animals and in cow-dung.
  S. distinguendus, *Lec.* In cow-dung, Montreal and Sorel.

2. Fam. *Phalacridæ*, Schaum.

(See Proc. Acad. Nat. Sci. Phila., Vol. VIII. p. 15.)

1. Olibrus, *Erich.*
  O. apicalis, *Mels.* On thorn-blossoms and by sweeping grass, June.

3. Fam. *Nitidulidæ*, MacLeay.

1. Phenolia, *Erich.*
  P. grossa, *Fabr.* One specimen taken under bark of a dead stump on the Mountain, August 24th, 1856.
2. Omosita, *Erich.*
  O. colon, *Linn.* Numerous under dead animals, &c., June.

4. Fam. *Engidæ*, MacLeay.

1. Ips. *Herbst.*
   I. fasciatus, *Oliv.* Not very common.
   I. quadrisignatus, *Say.* Extremely abundant in decaying vegetable matter, and flying in May.

5. Fam. *Cucujidæ*, Westw.

(See Proc. Acad. Nat. Sci. Phila., Vol. VII. p. 73.)

1. Læmophlæus, *Dej.*
   L. fasciatus, *Mels.* By sweeping grass on Logan's farm, August.
2. Silvanus, *Latr.*
   S. Surinamensis, *Linn.* Rare in houses.

6. Fam. *Cryptophagidæ*, Schaum.

1. Cryptophagus, *Herbst.*
   C. (*not determined.*) Under a dead rat in a cellar, Little St. James Street.
2. Atomaria, *Kirby.*
   A. (*not determined.*) Abundant by sweeping herbage on the Mountain, June.

7. Fam. *Lathridiidæ.*

(See Proc. Acad. Nat. Sci. Phila., Vol. VII. p. 299.)

1. Corticaria, *Marsham.*
   C. Americana, *Mann.* By sweeping grass, June.
2. Lathridius, *Illig.*
   L. reflexus, *Lec.* By sweeping grass, Logan's farm, October.

8. Fam. *Dermestidæ*, Leach.

(See Proc. Acad. Nat. Sci. Phila., Vol. VII. p. 106.)

1. Byturus, *Latr.*
   B. unicolor, *Say.* By sweeping herbage on the Mountain, June.
2. Dermestes, *Linn.*
   D. lardarius, *Linn.* Abundant in houses; very destructive to preserved specimens of natural history: also under bark of trees in autumn.
3. Attagenus, *Latr.*
   A. megatoma, *Fabr.* Abundant in houses, and very destructive to preserved specimens of natural history.

9. Fam. *Byrrhidæ*, Leach.

(See Proc. Acad. Nat. Sci. Phila., Vol. VII. p. 113.

1. Byrrhus, *Linn.*
   B. picipes, *Kirby.* Common.
   B. Americanus, *Lec.* Rare.
2. Cytilus, *Erich.*
   C. varius, *Fabr.* Rare, May.

LAMELLICORNES.

1. Fam. *Lucanidæ*, Leach.

1. Platycerus, *MacLeay.*
   P. depressus, *Lec.* Under bark of stumps on the Mountain.

2. Fam. *Geotrupidæ*, MacLeay.

1. Geotrupes, *Latr.*
   G. Blackburnii, *Fabr.* Very numerous about fresh horse-droppings at dusk.
   G. Egeriei, *Germ.* (Miarophagus, *Say.*) Woods on Belœil Mountain.
   G. excrementi, *Say?* In horse-dung on the Mountain.

3. Fam. *Scarabeidæ*, MacLeay.

1. Onthophagus, *Latr.*
   O. Hecate, *Pz.* Abundant in cow-dung, Montreal and Sorel.

4. Fam. *Aphodiidæ*, MacLeay.

1. Aphodius, *Illig.*
   A. fimetarius, *Fabr.* Very abundant in cow-dung everywhere.
   A. granarius. Under stones, and in great abundance in a decayed cabbage, May 1857; also in cow-dung at Sorel.
   A. curtus, *Hald.* In cow-dung.
   A. vittatus, *Lec.* In cow-dung, Montreal and Sorel.
   A. striatulus, *Say.* In horse-dung.
2. Euparia, *Lep.* and *Serv.*
   E. stercorator, *Hald.* One specimen taken under a stone on the Mountain, May.

5. Fam. *Trogidæ*, MacLeay.

(See Proc. Acad. Nat. Sci. Phila., Vol. VII. p. 211.)

1. Trox, *Fabr.*
   T. variolatus, *Mels.* On boarded pathways, May.
   T. æqualis, *Say.* April, Belœil Mountain.
2. Omorgus, *Erich.*
   O. punctatus, *Germ.* Rare, May.

6. Fam. *Dynastidæ*, MacLeay.

1. Xyloryctes, *Hope.*
   X. satyrus, *Fabr.* One specimen said to have been taken on the north-west side of the Mountain.
2. Ligyrus, *Burm.* (See Proc. Acad. Nat. Sci. Phila., Vol. VIII. p. 19.)
   L. relictus, *Say.* One specimen said to have been taken in Montreal, and another at Lachine, July.

7. Fam. *Melolonthidæ*, MacLeay.

(See Journ. Acad. Nat. Sci. Phila., Vol. III. sec. series, p. 235.)

1. Lachnosterna, *Hope.*
   L. fusca, *Frolich.* Very abundant flying about trees at dusk in May.
   L. cognata, *Burm.* Rare, May.
2. Serica, *MacLeay.*
   S. vespertina, *Schonh.* Under stones, sides of the Mountain, May.
   S. sericea, *Illig.* With the last species.
3. Hoplia, *Illig.*
   H. trifasciata, *Say.* (primaria, *Burm.*) On thorn-blossoms, &c., May and June.
   H. tristis, *Mels.* (*male of the preceding*). With the last species.

8. Fam. *Cetoniidæ*, MacLeay.

1. Trichius, *Fabr.*
   T. piger, *Fabr.* On blossoms of clover and on roses, June and July.
2. Osmoderma, *Lep.*
   O. eremicola, *Knoch.* Not very common, August.
   O. scabra, *Beauv.* Abundant on dead stumps, and crawling on the trunks of hard maples on the Mountain, August.

STERNOXI.

1. Fam. *Buprestidæ*, Leach.

(See Proc. Acad. Nat. Sci. Phila., Vol. IX. p. 7.)

1. Chrysobothris, *Esch.* (Odontomus, *Kirby.*)
   C. dentipes, *Germ.* Not common, July.
2. Dicerca, *Esch.*
   D. divaricata, *Say.* Abundant July to October, in dead trees.
3. Ancylocheira, *Esch.*
   A. maculiventris, *Say.* Common, July.
   A. striata, *Fabr.* Rare.
4. Melanophila, *Esch.*
   M. longipes, *Say.* Not common, June and July.
   M. fulvoguttata, *Harris.* Rare.
5. Agrilus, *Lap.*
   A. (*not determined.*) One specimen taken on the window of a house, July 17th, 1857.

2. Fam. *Eucnemidæ*, Westw.

1. Throscus, *Latr.*
   T. constrictor, *Say.* One specimen taken in a house near Montreal, October 1856.

3. Fam. *Elateridæ*, Leach.

1. Asaphes, *Lec.* (?) (Hemicrepidius, *Germ.*)
   A. memnonius, *Hbst.* Flies to light at night in July.
   A. decoloratus, *Lec.* Abundant sitting on the heads of umbelliferous plants, July.
2. Cratonychus, *Dej.*
   C. scrobicollis, *Lec.* Under bark of stumps, and under stones, on the Mountain, May.
   C. laticollis, *Erich.* On thorn-blossoms, June.
   C. communis, *Schonh.* Rare.
3. Adelocera, *Latr.*
   A. brevicornis, *Lec.* (?) Under bark of stumps on the Mountain, and swamps near Mile-end road, spring and autumn.
4. Elater, *Linn.*
   E. nigricollis, *Hrbst.* In rotten stumps on the Mountain.
5. Cryptohypnus, *Erich.*
   C. salaceipes, *Germ.* Abundant under stones on the Mountain, May.
6. Monocrepidius, *Lec.*
   M. dorsalis, *Say.* Under stones on grass, Montreal and Laprairie.

7. Corymbites, *Latr.*
   C. splendens, *Ziegl.* Under bark of a dead pine-stump, Laprairie.
   C. inflatus, *Say.* Rare.
   C. appressifrons, *Say.* Abundant on the Mountain in May.
8. Agriotes, *Erich.*
   A. mancus, *Say.* Under stones, and by sweeping herbage on the Mountain, June.
9. Dolopius, *Erich.*
   D. stabilis, *Lec.* By sweeping herbage on the sides of the Mountain, June.
   D. pauper, *Lec.* With the last species.

MALACODERMATA.

1. Fam. *Lycidæ*, Lec.

1. Digrapha, *Newm.*
   D. reticulata, *Fabr.* On the Mountain, June.

2. Fam. *Lampyridæ*, Leach.

(See. Proc. Acad. Nat. Sci. Phila., Vol. V. p. 331.)

1. Ellychnia, *Lec.*
   E. corrusca, *Linn.* Very abundant from April to October.
2. Pygolampis, *Lec.*
   P. marginella, *Lec.* This is the commonest firefly on the Mountain at night in July.
3. Photuris, *Dej.*
   P. Pensylvanica, *Geer.* (versicolor, *Fabr.*) Abundant, islands above Lachine, St. Hilaire and Sorel, June and July.

3. Fam. *Telephoridæ*, Leach.

(See Proc. Acad. Nat. Sci. Phila., Vol. V. p. 338.)

1. Chauliognathus, *Hentz.*
   C. Pensylvanicus, *Geer.* (bimaculata, *Fabr.*) Very abundant on the flowers of *Solidago*, Nun's Island and St. Hilaire, August.
2. Telephorus, *Geoff.*
   T. Carolinus, *Fabr.* By sweeping herbage, June.
   T. bilineatus, *Say.* On thorn-blossoms, June.
3. Podabrus, *Fischer.*
   P. rugulosus, *Lec.* Abundant by sweeping herbage, June.

4. Fam. *Cleridæ*, Westw.

1. Trichodes, *Herbst.*
   T. Nuttalii, *Kirby.* On blossoms of *Solidago*, Belœil Mountain, August.

5. Fam. *Ptinidæ*, Leach.

1. Ptinus, *Linn.*
   P. fur, *Linn.* Common in old houses.

6. Fam. *Anobiidæ*, Westw.

1. Anobium, *Fabr.*
   A. foveatum, *Kirby.* In dead wood.

HETEROMERA.

1. *Trachelia*, Westw.

1. Fam. *Anthicidæ*.

(See Proc. Acad. Nat. Sci. Phila., Vol. VI. p. 91.)

1. Anthicus, *Payk.*
   A. (*not determined.*) By sweeping herbage on the Mountain, June.

2. Fam. *Meloidæ.*

(See Proc. Acad. Nat. Sci. Phila., Vol. VI. p. 328.

1. Meloe, *Linn.*
   M. rugipennis, *Lec.* Common.
1. Asclera, *Schmidt.* (See Proc. Acad. Nat. Sci. Phila, Vol. VII. p. 20.
   A. ruficollis, *Say.* Very abundant in blossoms of *Erythronium maculatum* on the Mountain, May 1857.

4. Fam. *Melandryidæ*, Leach.

1. Melandrya, *Fabr.*
   M. striata, *Say.* Under bark of dead stumps on the Mountain, June.
2. Hypulus? *Payk.*
   H. (*not determined.*) One specimen taken in the old Museum of the Natural History Society, in Little St. James Street, Aug. 1857.

2. *Atrachelia*, Westw.

1. Fam. *Cistelidæ*, Leach.

1. Mycetocharus, *Latr.*
   M. (*not determined.*) Rare, July.
2. Cistela, *Fab.*
   C. sericea, *Say.* Abundant on blossoms of *Solidago* in August.

2. Fam. *Diaperidæ*, Stephens.

1. Diaperis, *Geoffr.*
   D. hydni, *Fabr.* Abundant in a species of *Boletus* on the Mountain in August and September.
2. Oplocephala, *Lap.*
   O. bicornis, *Oliv.* Abundant an a fungus on decaying stumps on the Mountain, August to October.
3. Bolitophagus, *Fabr.*
   B. cornutus, *Pz.* Abundant in *Boletus ignarius* on dead stumps on the Mountain, July.

3. Fam. *Tenebrionidæ*, Leach.

2. Tenebrio, *Linn.*
   T. molitor, *Linn.* Very common in old houses.
   T. tenebrioides, *Beauv.* Under bark of dead stumps on the Mountain.
2. Centronipus, *Dej.*
   C. calcaratus, *Fabr.* Under bark of dead stumps on the Mountain, October.
   C.? femoratus, *Fabr.* Common crawling on boarded paths, July and August.
3. Ipthinus, *Dej.*
   I. Pensylvanicus, *Geer.* Abundant under bark of dead trees, &c. on the Mountain and at St. Helen's Island.
4. Upis, *Fabr.*
   U. reticulatus, *Say.* Numerous under bark of dead trees on the Mountain and at Laprairie.

RYNCOPHORA.

1. Fam. *Bruchidæ*, Leach.

1. Cratoparis, *Dej.*
 C. lunatus, *Fabr.* Abundant in a fungus on stumps on the Mountain, August and September.

2. Fam. *Curculionidæ*, Leach.

1. Sitones, *Germ.*
 S. lepida, *Sch.* Abundant amongst grass.
2. Hylobius, *Germ.*
 H. pales, *Herbst.* Common, June.
3. Listroderes, *Sch.*
 L. (*not determined.*) One specimen taken flying, June 8th, 1857.
4. Balaninus, *Germ.*
 B. (*not determined.*) One specimen taken September 1856.
5. Cryptorhynchus, *Illiger.*
 C. luctuosus, *Sch.* Common on board-fences on the Mountain, May.
6. Conotrachelus, *Latr.*
 C. posticatus? *Sch.* By sweeping herbage on the Mountain, June.
7. Ceutorhynchus, *Schupp.*
 C. (*not named.*) Abundant in grass, June.
8. Sphenophorus, *Schonh.*
 S. (*not named.*) Common on sandy paths through fields, June and July.
9. Cossonus, *Clairv.*
 C. platalea, *Say.* Abundant under bark of dead stumps and trees on the Mountain.
10. Dryophthorus, *Schupp.*
 D. corticalis, *Say.* Under bark of stumps.

3. Fam. *Hylesinidæ*, Shuck.

1. Hylesinus, *Fabr.*
 H. aculeatus, *Say.* Taken by sweeping grass and in houses, July to October.

4. Fam. *Bostrichidæ*, Schaum.

1. Xylosterus, *Erichs.*
 X. (*not named.*) One specimen taken on a board-fence on the Mountain, May 1857.
2. Tomicus, *Latr.*
 T. pini, *Say.* Rare, in houses.

LONGICORNES.

I. *Prioni*, Lec.

(See Journ. Acad. Nat. Sci. Phila., Vol. II. second series, p. 107.)

I. Fam. *Prionidæ*, Leach.

1. Orthosoma, *Serv.*
 O. unicolor, *Drury.* Not uncommon; in decayed stumps, and flying by night, July, Montreal and Sorel.

II. *Cerambyci*, Lec.

1. Fam. *Lepturidæ*, Leach.

(See Journ. Acad. Nat. Sci. Phila., Vol. I. second series, p. 316.)

1. Desmocerus, *Serv.*
   D. palliatus, *Forst.* Rare, July.
2. Acmæops, *Say.*
   A. proteus, *Kirby.* Very abundant, June to August.
3. Evodinus, *Lec.*
   N. sp.? One specimen taken May 1859.
4. Typocerus, *Lec.*
   T. fugax, *Fabr.* Abundant on the heads of umbelliferous plants in orchards on the Mountain, July and August.
5. Leptura, *Linn.*
   L. Canadensis, *Fabr.* Abundant, July and August. Montreal and Sorel.

2. Fam. *Cerambycidæ*, Leach.

(See Journ. Acad. Nat. Sci. Phila., Vol. II. second series, p. 5.)

1. Elaphidion, *Serv.*
   E. parallelum, *Newm.* Rare, July.
2. Arhopalus, *Serv.*
   A. speciosus, *Say.* Not common. Larva in hard-maple trees.
   A. pictus, *Drury.* Very abundant on flowers of *Solidago*, September Larva on the locust-tree (*Robinia pseudacacia*), in gardens.
3. Clytus, *Fabr.*
   C. ruricola, *Oliv.* (hamatus, *Say.*) Rare, July.
   C. colonus, *Lec.* Common, July and August.
4. Physocnemum, *Hald.*
   P. ligneum, *Fabr.* Not uncommon, Montreal and Belœil Mountains, May.
5. Phymatodes, *Mulsant.*
   P. dimidiatus, *Kirby.* Very rare.
6. Callidium, *Fabr.*
   C. janthinum, *Dej.* (antennatum, *Newm.*) Common, May to July. Abundant at Sorel.
7. Criocephalus, *Mulsant.*
   C. agrestis, *Kirby.* Common. Abundant at Sorel, July.

(*To be continued.*)

MONTHLY METEOROLOGICAL REGISTER, ST. MARTINS, ISLE JESUS, CANADA EAST, (NINE MILES WEST OF MONTREAL,) FOR THE MONTH OF JUNE, 1859.

Latitude, 45 degrees 32 minutes North. Longitude, 73 degrees 36 minutes West. Height above the level of the Sea, 118 feet.

BY CHARLES SMALLWOOD, M.D., LL.D.

Day of Month	Barometer, corrected and reduced to 32° F. (English inches.)			Temperature of the Air. F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere			Direction of Wind			Mean Velocity in Miles per hour			Amo'nt of Rain in inches.	Amo'nt of Snow in inches.
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 a. m.	10 p. m.		
1	29.955	29.788	29.881	59.0	84.6	64.5	439	758	497	88	66	83	S. S. E	S. by E.	S. W. by S.	0.14	3.61	3.72		
2	724	620	701	64.0	78.4	69.6	440	678	496	75	73	70	W. by S	S. S. E.	W. S. W	5.42	6.50	12.83	0.270	
3	717	681	330	55.7	78.0	49.7	370	443	265	84	46	75	S	S. E. by E	N. W.	5.18	5.02	17.88	Inapp.	...
4	929	912	970	41.9	48.1	45.0	160	218	211	65	64	72	N. by E	W. by S.	S. by W	11.63	4.93	1.53		
5	900	875	930	41.8	58.0	51.0	169	255	204	65	53	55	N. N. E	S. by W.	W. by S	12.98	6.31	1.05		
6	908	914	964	50.3	73.6	59.0	283	469	275	78	57	56	S. W.	W. S. W	S. W.	6.83	10.93	7.48		
7	998	848	851	47.0	84.0	61.0	278	597	436	85	53	77	W. by S	W. S. W	W. N. W	2.63	4.81	3.82		
8	615	847	532	58.1	69.4	84.0	400	509	328	84	85	77	S. by W	W. by S	W. N. W.	6.07	12.48	14.42	0.913	
9	759	696	742	42.1	62.9	52.0	222	355	261	83	58	69	W. by N	S. W. by W.	S. W	18.73	8.80	1.11		
10	648	644	802	52.3	50.9	47.4	328	283	421	84	78	48	W. by S	W. S. W.	N. W.	1.86	6.09	10.42	0.263	
11	920	981	30.097	40.2	53.2	43.0	173	194	190	73	48	74	W. N. W	W. N. W	W. N. W	8.37	11.42	5.21		
12	30.087	997	29.810	42.6	62.4	55.6	206	263	288	78	48	65	S. S. W	W. S. W.	W. by N	0.00	1.13	7.98		
13	29.741	660	711	57.2	60.4	60.3	350	462	487	75	91	94	S	S. by W.	S.	13.40	8.17	3.00	0.273	
14	896	760	840	52.2	69.5	59.2	282	440	390	73	61	88	N. E.	S.	S. S. W	10.01	1.81	0.22		
15	750	576	516	63.0	86.6	68.0	478	850	642	83	68	97	S	S. W. by S.	S. W	0.03	3.53	12.20	1.850	
16	601	672	789	67.2	58.2	57.8	594	426	424	89	91	91	W. by S	N. E. by E	S. W	5.84	5.15	1.16	0.930	
17	849	901	852	50.0	68.7	58.2	265	261	361	75	38	70	E. by N.	E. by N	N. E	3.80	2.37	2.80		
18	641	682	800	52.2	68.1	56.1	360	543	385	93	79	84	N. E. by E	S. W.	W. by S	13.40	1.22	7.44	1.364	
19	804	784	897	55.0	75.0	61.0	308	519	390	71	60	74	W. S. W	W. S. W	W. S. W	0.90	5.96	3.92		
20	874	776	710	51.0	77.2	60.2	277	666	[illegible]	79	77	88	S. W.	S. W.	E. by S.	5.97	1.47	3.16		...
21	601	489	602	59.1	61.3	62.5	476	503	491	97	86	88	S. S. W	S. S. W.	S. S. W.	1.62	4.68	4.17	0.240	
22	592	612	800	57.0	68.6	61.0	385	504	449	84	75	80	W. S. W	W. S. W	S. W. by W.	2.87	8.72	2.62		
23	897	890	984	61.[illegible]	83.0	66.3	449	667	542	85	62	87	S. W. by W.	S. S. W	S. by W	0.80	1.49	0.82		...
24	993	914	931	61.0	66.3	61.0	456	452	480	88	87	81	S. E	S. E.	S. by E	0.03	0.92	0.42	0.230	
25	769	702	766	58.1	75.8	64.7	452	628	456	94	73	80	N. N. E	W. S. W	W.	0.00	2.03	1.48	Inapp.	
26	830	814	918	65.3	8[illegible].1	64.0	526	657	502	84	56	72	S. W	W. S. W	W. S. W	1.22	2.15	4.61		
27	[illegible]	840	774	57.0	80.6	73.0	378	855	[illegible]	84	62	70	S. W. by S	S. by W	S. by W	1.37	3.96	8.04		
28	778	745	817	75.0	84.5	77.0	751	746	758	88	64	82	W. N. W	N. W.	S. W. by W	14.26	10.05	2.97	0.210	
29	575	426	550	79.0	80.0	70.9	372	761	[illegible]	78	56	[illegible]	W. S. W	S. W. by W	N. W. by N	3.67	13.85	10.93	Inapp.	
30	677	714	866	50.0	68.0	57.8	260	319	322	82	47	69	W.	W	W	14.40	28.34	0.67	0.176	

Weather, Clouds, Remarks, &c., &c.

[A cloudy sky is represented by 10, a cloudless one by 0.]

Day	6 a. m.	2 p. m.	10 p. m.
1	Cu. Str. 10.	Clear.	Str. 3.
2	Cirr. Str 9	Cu. Str. 8.	Clear.
3	Clear.	" 6	Str. 2
4	C. Str. 8	C. C. Str 8	Clear.
5	Cirr. Str 4	" 3.	Cirr. Str 4.
6	Clear.	Cirri 2.	Clear.
7	Clear.	Clear.	C. C. Str 9.
8	C. C. Str 10	Rain, with thunder	C. Str. 4
9	Clear.	Cirri Str. 4.	Str. 2
10	C. Str 10	Cirri Str. 8	Clear.
11	Clear.	C. C. Str 8	Clear.
12	Cirr. Cum 6	" 10	C. C. Str. 6.
13	C. Str. 9	Rain.	C. Str. 10
14	" 9	Cu. Str 6	Cirr. Cum. 4
15	C. C. Str 8.	C. C. Str 10.	Rain
16	Cu. Str. 6	Rain.	C. Str 9
17	Clear.	C. C. Str 6	" 10
18	Rain	Cu. Str 8	Clear
19	Clear	Clear.	Clear.
20	"	C. C. Str. 8	C. Str 10.
21	Cu. Str 10	Cu. Str 8	" 8.
22	" 8	" 9.	" 2.
23	Clear.	C. Str 4.	Clear.
24	Cu. Str 10	Cu. Str 10. der.	C. Str. 10
25	" 10	" 6. Thun-	Clear
26	Clear	Cirr. 2	Clear
27	"	Cu. Str. 4	Str. 2.
28	Cumulus 10	C. C. Str. 4.	Str. 2.
29	C. C. Str 4	Rain thunder	Cu. Str 10.
30	Cu. Str 10	Clear.	Clear.

REPORT FOR THE MONTH OF JULY, 1859.

Day	Barometer 6 a. m.	2 p. m.	10 p. m.	Temp. 6 a. m.	2 p. m.	10 p. m.	Tension 6 a. m.	2 p. m.	10 p. m.	Humidity 6 a. m.	2 p. m.	10 p. m.	Wind 6 a. m.	2 p. m.	10 p. m.	Velocity 6 a. m.	2 p. m.	10 p. m.	Rain
1	29.821	29.850	29.762	59.0	71.3	61.0	352	[illegible]	419	70	48	80	W. S. W.	W. S. W	W. S. W	2.24	[illegible]	5.59	
2	521	463	520	67.2	81.8	72.2	591	773	675	89	[illegible]	88	S. S. W	S. S. W	W. S. W	1.47	5.74	15.32	Inapp.
3	586	700	895	57.4	62.4	50.4	259	281	228	68	51	64	N. by W	N. by W	N. N. E	12.22	7.60	4.22	
4	30.041	30.115	30.134	45.0	68.7	53.3	212	319	165	60	47	91	N. N. E	S. S. E	S. S. W	6.94	[illegible]	0.45	
5	101	175	292	45.1	80.2	61.0	269	504	419	[illegible]	50	89	S. S. W	S. by W	S. by W	0.00	0.00	[illegible]	
6	134	125	038	61.2	[illegible]	67.2	564	650	[illegible]	77	51	71	S. S. W	S. S. W	S. S. W	0.08	2.06	0.24	
7	047	29.979	29.980	65.0	76.7	67.5	471	577	[illegible]	81	64	[illegible]	S. S. W	S. W	S. W	[illegible]	2.12	0.42	
8	29.918	896	914	[illegible]	82.2	[illegible]	520	572	[illegible]	[illegible]	52	81	S. W	W. by S	W. by S	[illegible]	0.92	1.60	
9	30.012	30.063	30.0[illegible]	63.5	84.1	67.0	[illegible]	547	[illegible]	68	[illegible]	71	E	N. N. E	S. S. E	[illegible]	[illegible]	0.72	
10	016	049	29.9[illegible]	70	[illegible]	72.0	642	650	[illegible]	[illegible]	47	[illegible]	S. S. W	S. by E.	S. S. E	0.43	2.06	[illegible]	
11	29.8[illegible]	29.7[illegible]	[illegible]	64.6	[illegible]	[illegible]	[illegible]	759	[illegible]	71	[illegible]	[illegible]	S. by W.	S. S. W	S. S. W	[illegible]	7.77	0.81	
12	[illegible]	777	[illegible]	72.0	[illegible]	[illegible]	681	915	[illegible]	[illegible]	[illegible]	[illegible]	S. S. W.	S. S. W	S. by E.	0.01	[illegible]	[illegible]	
13	880	962	929	70.9	[illegible]	67.0	751	[illegible]	[illegible]	[illegible]	[illegible]	77	N. N. E	E. by S	E. S. E	0.82	6.73	1.70	0.100
14	957	[illegible]	[illegible]	68.1	[illegible]	[illegible]	504	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	E. S. E.	N. E. by E	E	1.22	[illegible]	[illegible]	
15	990	774	[illegible]	[illegible]	73.0	[illegible]	556	651	571	77	[illegible]	81	N. E. by E.	S. E	S.	1.40	[illegible]	10.06	Inapp.
16	719	710	728	65.5	87.0	70.1	529	670	[illegible]	[illegible]	[illegible]	[illegible]	S. E. by S.	S. S. E	S. by W	6.02	[illegible]	0.96	
17	753	757	[illegible]	70.1	77.1	71.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	S. S	S. S. W	E	1.10	4.13	0.11	0.110
18	690	586	591	67.9	80.9	68.2	[illegible]	[illegible]	[illegible]	[illegible]	62	87	E. by S	S. S. E	S. E. by E.	[illegible]	0.71	[illegible]	
19	689	480	[illegible]	67.9	92.1	77.0	[illegible]	[illegible]	[illegible]	87	52	[illegible]	E. by S	S. S. E	S. S. W	[illegible]	[illegible]	[illegible]	
20	[illegible]	393	[illegible]	[illegible]	[illegible]	52.4	829	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N. W	N. by W	W. by N	7.46	[illegible]	13.01	0.170
21	677	595	[illegible]	[illegible]	75.6	64.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	W. S. W	W	W. S. W	[illegible]	[illegible]	[illegible]	
22	467	428	452	67.0	[illegible]	57.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	S. S. E	W. by S	N. W. by W.	3.11	[illegible]	[illegible]	0.218
23	500	[illegible]	674	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	71	[illegible]	78	N. N. W	W.	W.	[illegible]	[illegible]	[illegible]	0.070
24	[illegible]	747	741	48.3	[illegible]	[illegible]	285	479	[illegible]	[illegible]	52	71	W	W. S. W	S. W. by S	10.01	11.57	[illegible]	
25	704	[illegible]	747	60.6	71.9	57.0	456	[illegible]	[illegible]	[illegible]	[illegible]	57	S. S. E	S	S. by E.	0.00	2.07	5.81	
26	652	524	578	60.0	62.5	[illegible]	[illegible]	[illegible]	571	91	[illegible]	[illegible]	E. S. E	S. E	W. S. W	0.11	0.33	7.03	1.780
27	477	474	797	52.2	65.1	58.8	[illegible]	420	[illegible]	[illegible]	68	91	W. by S	N. N. W	W. by N	[illegible]	8.95	13.57	Inapp.
28	634	620	791	63.2	73.9	57.8	478	510	[illegible]	[illegible]	[illegible]	91	W. by S	W. S. W	S. W.	3.73	5.00	[illegible]	
29	902	829	970	60.8	80.6	63.5	505	[illegible]	[illegible]	95	59	92	S. W.	S. S. W	S. S. W	0.15	0.75	0.44	
30	962	905	852	64.7	87.0	68.9	523	557	458	86	45	79	S. S. W	S	S. E. by E	0.37	0.26	0.23	
31	872	853	791	62.4	90.0	69.1	189	889	564	91	42	79	E. S. E.	S. E. by E.	E. S. E	0.00	0.22	4.67	

Day	6 a. m.	2. p. m.	10 p. m.
1	Clear	Clear.	Clear
2	Cu. Str 10	C. C. Str 10	Cirri 2
3	" 6	" 4	Clear.
4	Clear	Clear	Clear
5	"	"	Str. 2
6	"	"	Clear.
7	C. C. Str	C. Str. 10	C. C. Str. 4
8	"	Cir. Cum 4	Cirri 2
9	Clear	Cirri 2	Clear.
10	Light C[illegible]	C. Str 6	C. C. Str 8.
11	Clear	Cu. Str. 8	Cu. Str 8. Aurora Borealis
12	"	Clear	Str 4 Lightning
13	Cu. Str		Clear.
14	C. C. Str	"	C. C. Str. 6
15	Cir. Str.	Cu. Str 10	Cu. Str 8.
16	Cu. Str 10	C. C. Str 6 der.	" 10.
17	Clear	Cu. Str 6 Thun-	Clear
18	"	Cu. Cir 8	Cu. Str 8
19	"	Cirr. 6	" 9 Thunder.
20	Cu. Str 10	C. C. Str 1	Clear.
21	Clear	Cu. Str 6	Cu. Str. 8.
22	Cu. Str 8	" 8	Rain, thunder
23	Clear	1	Clear
24	"	1	Str. 2
25	C. C. Str	" 6	Clear
26	Fog.	Rain	Cu. Str. 10.
27	C. C. Str 8	Cu. Str 10. der.	Clear.
28	" 8	" 1 Thun-	Str. 2.
29	Cir. Str 4	" 8	Clear Aurora Borealis
30	Clear	Clear	"
31	Cirr. 2	"	"

REMARKS FOR JUNE, 1859.

Barometer { Highest, the 30th day, 30.097 inches.
Lowest, " 29th " 29.426 "
Monthly Mean, 29.784 inches.
Monthly Range, 0.671 "

Thermometer { Highest, the 27th day, 91°.6.
Lowest, the 12th day, 31°.1
Monthly Mean, 62°.00.
Monthly Range, 59°.9.

Greatest intensity of the Sun's rays, 101°.4
Lowest point of terrestrial radiation, 24°.2
Mean of humidity, .706.
Amount of evaporation, 2.89 inches.

Rain fell on 14 days, amounting to 6.779 inches; it was raining 18 hours 30 minutes, and was accompanied by thunder on 5 days.
Most prevalent wind, the W.
Least prevalent wind, E. by S.
Most windy day, the 30th day; mean miles per hour, 14.84.
Least windy day, the 24th day; mean miles per hour, 0.53.
Aurora Borealis visible on 0 nights.
The Electrical state of the atmosphere has indicated high tension.
Ozone was present in rather large quantity.
Solar Halo on the 12th day.
Frost on the 5th, 6th, 11th and 12th day.

REMARKS FOR JULY, 1859.

Barometer { Highest, the 5th day, 30.292 inches.
Lowest, " 22nd " 29.382 "
Monthly Mean, 29.[illegible] inches.
Monthly Range, 0.864 "

Thermometer { Highest, the 12th day, 97°.7
Lowest, " 4th " 36°.1
Monthly Mean, 67°.58.
Monthly Range, 61°.6.

Greatest intensity of the Sun's rays, 110°.1
Lowest point of terrestrial radiation, 27°.5
Mean of humidity, .705.
Amount of evaporation, 3.61 inches.

Rain fell on 9 days, amounting to 2.428 inches; it was raining 15 hours 35 minutes, and was accompanied by thunder on 7 days.
Most prevalent wind, S. W.
Least prevalent wind, E.
Most windy day, the 20th day; mean miles per hour, 11.34.
Least windy day, the 5th day; mean miles per hour, 0.61.
Aurora Borealis visible on 2 nights.
Parhelia on the 9th day.
Frost on the 4th and 5th days.
The Electrical state of the atmosphere has indicated high tension.
Ozone was present in moderate quantity.

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THE

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ART. XXIV.—*On a New Species of Stickleback* (*Gasterosteus gymnetes*). By J. W. Dawson, LL.D., &c.

(Read before the Natural History Society.)

I propose in this paper to redeem from unmerited neglect an inhabitant of our brooks, the six-spined stickleback, which, though very well known to the boys of Montreal, and much persecuted by them, has, in so far as I am aware, hitherto escaped the notice of naturalists. It belongs to a group of little fishes, represented by many species in the fresh-waters and on the coasts both of the old and new world, and remarkable for their armature of sharp spines, their active and pugnacious habits, and the provision which they make for the care of their spawn.

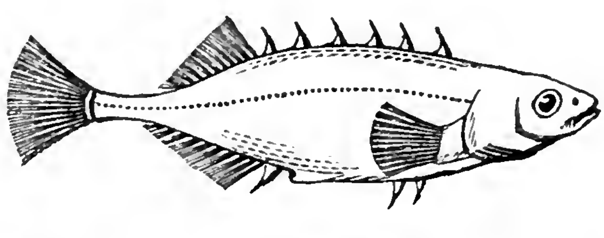

Fig. 1.—*Gasterosteus gymnetes* (male).

The present species makes its appearance in the brooks immediately after the melting of the snows in spring. It is then plump and active, and the females are laden with spawn. The spawn is deposited in the end of March or beginning of April, in a globular

nest about the size of a musket-bullet, constructed of green algæ, and placed in a tuft of submerged grass or aquatic weeds. My eldest boy, who first showed me the nest, assures me that one of the parents, probably the male, as in the case of a common British species, remains near the precious deposit, and drives away all intruders. The ova are translucent and colourless, and of the size of a pin-head. They soon exhibit to a close inspection with the naked eye or a magnifying-glass of moderate power, two black specks, the rudiments of the eyes of the future fish; and under the microscope present the appearance represented in figure 2,

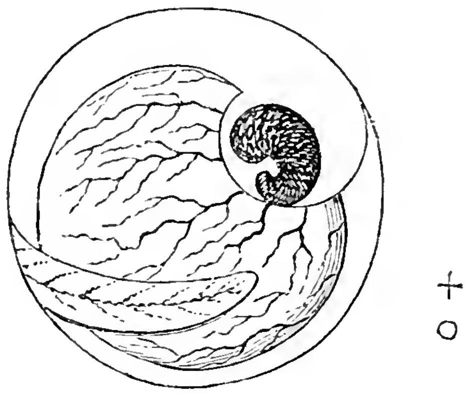

Fig. 2.—*Egg of G. gymnetes* (magnified).

the embryo being coiled up in the usual manner around the yolk-bag, and occasionally moving by convulsive jerks. At this stage I observed that microscopic animalcules had obtained access to the interior of several of the eggs, and evidently occasioned annoyance to the embryo. I have reason to believe that several embryos were destroyed in this way, and perhaps the carefully-built nest may have for one of its objects to guard against such attacks.

In two or three weeks the young extricate themselves from the egg—still only about a tenth of an inch in length, and having the yolk bag attached to the abdomen, as represented in figure 3.

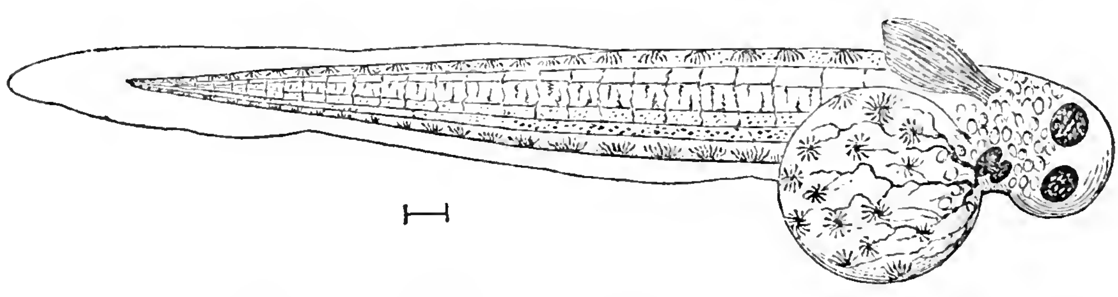

Fig. 3.—*Embryo of G. gymnetes* (magnified).

They swim quickly, and are nearly as dexterous as the adults in avoiding danger and availing themselves of places of concealment. They are now very beautiful objects for microscopic investigation. The head appears a rounded mass of cells. The eyes, however, are well developed, and can be rotated as perfectly as in the adult.

The pulsation of the heart, seen immediately in front of the yolk-bag, and the movement of the blood in the vessels of the yolk-bag, in the aorta and the large veins above and below the spinal column, as well as in the transverse branches passing between the muscular flakes of the sides, can be very distinctly perceived. The spinal column appears as a uniform cartilaginous hyaline cord, and the pectoral fins are fully developed and in constant motion. The posterior part of the body is surrounded by a delicate membranous fin, terminating in a rounded point at the tail.

As the yolk-bag diminishes in size, beautiful stellate pigment cells become developed in the skin, and render it too opaque to permit the interior structures to be well seen; and before the little creature has attained the length of one-sixth of an inch, it has all the appearance of the adult, and may be seen slowly swimming or hovering, with its bright eyes rolling in search of the minute crustaceans, worms, rotifers and animalcules which form its prey, and which it seizes by sudden, quick darts. When alarmed, it hides under stones or algæ, or remains motionless over some part of the bottom resembling its own colour, which, when it is irritated or frightened, deepens almost into black.

The fry remain in the brooks throughout the spring and early summer; but the greater part disappear, descending I suppose into the river, before autumn. Those that remain are now (September) nearly an inch in length, and will probably be full-grown next spring.

The following is the description of the adult in spring:—

Length, two inches; head to body, as 1 to 4; depth of body to length, as 1 to 4. Form, compressed, especially above; back, regularly arched to the end of the dorsal fin, from which it curves upward slightly to the insertion of the caudal fin. Head, regularly conical, obliquely truncated by the lower jaw. Eye, prominent, diameter one-tenth of an inch. Nostril, half-way between eye and pre-maxillary, and on a level with the upper part of the orbit. Body, quite destitute of bony plates; on this last character, the absence of defensive armour, I have given it the specific name *gymnetes*. Pre-operculum, bent nearly at a right angle, rounded at apex. Operculum, rounded below, nearly straight above, rounded at superior posterior angle. Brancheostegal rays, three. Mucous pores, three above each eye, a few very small under the eye; on the occiput a curved row of pores convex backward; at the edge of the operculum two less distinct rows convex upward.

Scapular bones not visible externally. Pectoral fin, broad, separated by a rounded triangular space from the operculum, nearly straight above, rounded below, composed of eleven rays, the two lower soft and simple. Ventrals, consisting each of a stout spine, with the base sheathed in the integument. Pelvic bones, very narrow and pointed backward, thickly covered by integument. Dorsal spines, 5 or 6 (in so far as observed, 5 in the female, 6 in the male); short, stout, and with broad, triangular membranes; anterior spine shortest; spines usually only partially erected, and, when depressed, concealed in the dorsal groove; second dorsal of ten rays, second and third longest; the others rapidly diminishing toward the posterior end of the fin. Anal fin with one detached, curved, stout, membraned spine in front, in form similar to dorsal, and with ten rays. Caudal fin, broad at base, even posteriorly, of fourteen rays. First dorsal spine, above the insertion of the pectoral fin; last, above the beginning of the anal fin. Colour above, dull dark olive, with irregular darker blotches; abdominal region and lower part of gill-covers, pearly gray. Whole body dotted with minute black points. Male darker than female.

This species is found plentifully in most of the small streams near Montreal. Its food appears to consist principally of minute worms and crustacea. Its armature of spines and quickness in hiding enable it to inhabit with safety very shallow and exposed places; but it is easily taken with a dip-net, and great numbers are captured by young anglers for bait. It is easily kept in aquaria, finding its food in the minute inhabitants of the water, if a few tufts of algæ are kept to shelter and feed them. It has however the bad character of attacking and destroying other small fishes with its formidable spines.

I am indebted to Mr. Putnam, assistant to Prof. Agassiz in the Museum of Comparative Anatomy at Cambridge, for comparing this species with specimens in that collection or described in the United States. It is nearly allied to *G. millepunctatus* of Ayres.

I am indebted for the outline in Figure 1, to Mr. R. J. Fowler, who has been so successful in representing our larger Canadian fishes.

ARTICLE XXV.—*On Some of the Glacial Phenomena of Canada and the north-eastern Provinces of the United States during the drift period.* By Professor ANDREW C. RAMSAY, F.R.S., F.G.S., Local Director of the Geological Survey of Great Britain.

(From the Journal of the Geological Society of London.)

Glacialized condition of the Laurentine Mountains; and the drift-deposits of Montreal.—In the Straits of Bellisle, the barren coast of Labrador consists partly of low patches of red sandstones, &c., lying almost horizontally on the Laurentian series—that most ancient system of gneiss and granite which forms the eastern extremity of the great Laurentine chain. These gneissic rocks are rounded and largely mamillated, as if by the action of ice; and all the distant hills, quite bare of trees, possess the same sweeping contours. The gnarled strata of the lofty Bellisle itself, to the very summit, show unequivocal signs of the same abrasion, their well-worn outcrops presenting none of those jagged outlines that all highly-disturbed beds are apt to assume when exclusively weathered by air, rain, and open frost. Similar forms prevail far up the St. Lawrence, on its north shore, easily distinguishable in spite of the forests which, before we reach the Saguenay, rise to the tops of the mountains, leaving here and there unwooded rocky patches. Further up the river, by the Isle aux Coudres (about 50 miles below Quebec), I became more and more impressed by similar appearances. Not a peak is to be seen; and to the top every hill seemed *moutonnée.* Like much of Wales, Ireland, and the Highlands of Scotland, the country appeared *moulded by ice.*

On the south side of the river the country is low, being formed of Silurian strata chiefly covered with drift from the Laurentine chain; and the vast quantity of boulders and smaller stones that cover the land help to impress on it a poor agricultural character.

Approaching Montreal, the gneissic mountains recede to the northwest; and both banks of the river are low, except where an occasional boss of greenstone pierces the Silurian strata. Montreal Mountain, about a mile behind the city, is one of these, rising boldly out of the terraced drift of the plain.

This drift consists of clay, with Laurentian boulders and boulders of greenstone from the mountain, both mixed with subangular gravels of Utica slate and Trenton limestone, which formations rise on its flanks. Many of the boulders and smaller stones are grooved, or more finely scratched, in a manner undistinguishable from the scratched stones of the British and Alpine drift or of Alpine

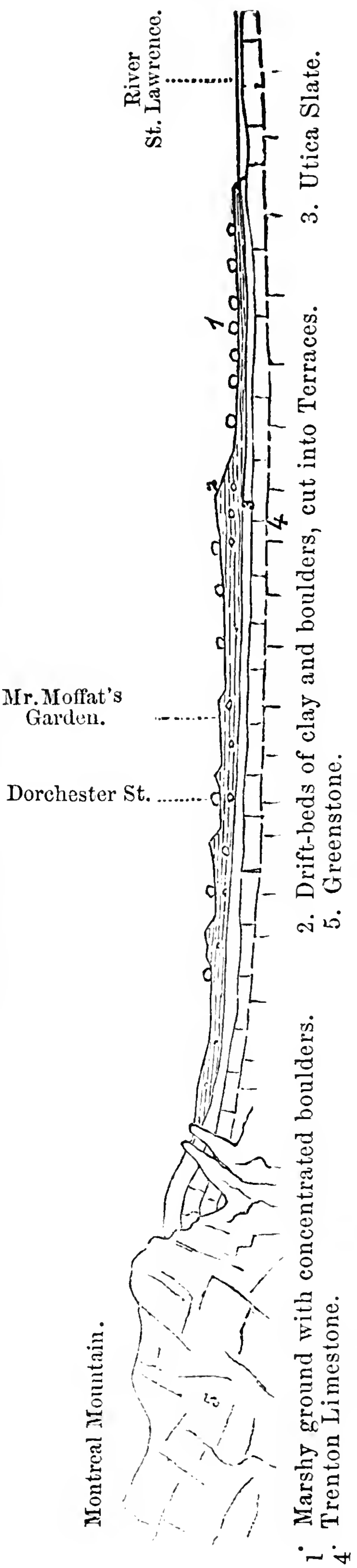

Fig. 1.—*Diagram-section of the Drift Deposits at Montreal*

glaciers. We are indebted to Dr Dawson of Montreal for the three important subdivisions of the superficial deposits,—namely, 1st, at the base, lower boulder-clay and gravel ; 2ndly, an unctuous clay, with many marine shells, called by him the "Leda-clay" (*Led-Portlandica*), on which lie, 3rdly, beds of gravel and sand, with shells, one of the most common of which is *Saxicava Rugosa.* These subformations occasionnally pass into each other where they join. The Saxicava sand he considers to have been a shallow and sublittoral deposit ; the Leda-clay to have been accumulated at depths of from 100 to 300 feet or more ; and the true boulder-clay to have been formed at an earlier period of subsidence, during which an ocean spread over the greater part of North America. I shall have occasion to show that at one time this sea was, in places, probably over 3000 feet in depth. The section (fig. 1)* across the drift, which I drew at Montreal, nearly agrees with Dr. Dawson's, with the exception that I show five terraces in the drift, while he gives two. Their number may vary in different localities; but they have certainly been formed during the last emergence of the country, each terrace indicating a pause in elevation ; and in a great degree the shells of the upper strata lie in a debris of remodelled drift. The two upper terraces, to the left of

* For the Silurian geology of this diagram, I am indebted to the description of Sir Wm. Logan.

Dorchester Street, correspond to Dr. Dawson's Leda-clay and Saxicava-sand.

Between the lowest terrace and the river there is a broad marsh, including patches of recent freshwater shells. It is part of the old course of the St. Lawrence; and on its surface (the lighter drift having been removed) the boulders that once studded the clay have been concentrated. Similar terraces occur on the banks of the Ottawa. The country is strewn with boulders of gneiss and metamorphic limestone, from the neighbouring Laurentine chain, mixed with more local debris; and here also it seemed, in several cases, as if, by removal of the lighter material, the boulders were more concentrated on the lower than on the highter terraces. Many of the blocks are rounded; in this respect differing markedly from the majority of those on glaciers, in moraines, and probably from those transported by icebergs, which, derived from glaciers that reach the sea-level, obtain their debris by the fall of rocks and stones on their surfaces from inland cliffs. In the American hills which I saw, there are no signs of true glaciers like those of the Alps having existed; and the boulders have been transported by floating ice from old sea-shores, where they had been long exposed to the washing of the waves.

At Hawksbury Mills I crossed the Ottawa with Sir William Logan, and penetrated part of the Laurentine hills lying several miles from the north bank of the river. Waterworn gravel here and there rises nearly to their summits, now rarely more than 500 or 600 feet above the river.

In the range about eight miles north of the Ottawa, there are well-rounded and occasionally grooved surfaces of gneïss greenstone, and quartz-rock,—the striations, where I saw them, running 10° and 20° W. of S.

In many places, among the hills, numerous half-rounded boulders (of the same substances as those that strew the plains of the Ottawa and the St. Lawrence) cover the ground, and appear as if they had been waiting their turn for glacial transportation, ere the country was raised above the sea. These general signs existing in this chain, in latitude 45½° N., gave me more perfect confidence in the universal glacial abrasion of the hills on the coast of Labrador in a latitude nearly 150 miles further north.

Glacial Drift of the Plains; Striæ and Roches moutonnées.—I need not indulge in repeated descriptions of the drift that covers the plains of Canada and the northern States. It is

enough to say that the descriptions given by previous writers are strictly correct. The whole country is literally covered with drift,—to such an extent, indeed, that except in denuded water-courses and deep gorges, like those of the Genesee and Niagara, it is only in rare cases that the rock is exposed. Even railway-cuttings rarely penetrate to the rocks below. It may be compared, in Europe, to the northern plains of Germany. In horizontal extension it is the most widely spread of all deposits; and even in thickness it rises to the dignity of a great formation, having by Logan and Hall been estimated in places at 500 and 800 feet in thickness†. In all cases the Laurentian boulders, which have often travelled hundreds of miles, are mixed with fragments of the rocks that crop out northward towards the Laurentine hills, and with stones from the strata of the immediate neighbourhood,—the number of the component materials of the drift thus generally increasing to the south‡, marking the fact that the lowlands as well as the mountains have been subject to the denuding and transporting agency of ice. At a distance from the mountains, the boulders become comparatively few; and it is this admixture of calcareous and other material, often lightened with sand, that fertilizes the soil in the great plains that surround the lakes.

The City of Ottawa stands on Trenton limestone; and the surrounding country is strewn with boulders of Laurentian gneiss and Trenton limestone itself, and of Potsdam sandstone, &c.

Between Ottawa and Prescott on the St. Lawrence, the basement-rock is rarely seen. The country is chiefly covered with gravel containing boulders of gneiss from the hills, and of Silurian rocks from the plains. Here and there are patches of sand containing pebbles and small boulders, generally rounded. In some places it has the appearance of blown sand,—an effect that may have been produced as the land emerged from the sea.

The shores of Lake Ontario, in general, consist of low and shelving slopes of drift; but at Scarborough bold cliffs of sand, gravel, and clay partly white with boulders, rise 320 feet above the lake. The terraces of Toronto have been described by Sir Charles Lyell. They are like those of the St. Lawrence and the Ottawa. The lower part of the city stands on a very stiff boulder-clay, containing large and small boulders, many of them scratched. Somewhat higher there are beds of beauti-

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† I had an opportunity of examining the drift in many places between Quebec and London (which lies between Lake Huron and Lake Erie) about 500 miles from N.E. to S.W. in a direct line, and from north to south between Montreal and Ottawa, to Blossburgh and New York.

‡ See Murray's Report, Geological Survey of Canada, 1856.

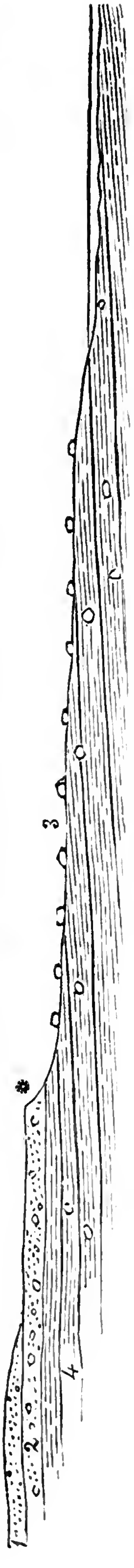

Fig. 2.—*Section of the Drift-terraces at Toronto.*

Lake Ontario. Sand.

1. Sand.
2. Sand with boulders.
3. Boulders left after the removal of the sand by denudation.
4. White laminated clay, containing some boulders.

fully laminated brick-clays, similar to the clay of the Hudson Valley, afterwards to be described, and probably its equivalent. In 1857, great railway-cuttings were in progress in the lower clay. The terrace marked * in fig. 2 consists of sand with Laurentian and other boulders resting on white brick-clay, which is beautifully laminated, and in which similar boulders are more sparingly scattered.

The removal of the sand by denudation, to form the terrace, has produced a great concentration of gneissic and other boulders on the surface between the terrace and the lake.

In the great plains between Lake Ontario, Erie, and Huron, the drift of gravel, sand, and clay, with many large and small striated boulders, is frequently of great and unknown thickness. White clay occurs round London ; and from this the bricks are made of which the town is built. The geologist may here travel twenty or thirty miles without seeing rocks in place. In the gravels near Hamilton, elephantine remains were found, supposed by Dr. Dawson to have been washed from the table-land of the Niagara escarpment when the lower plain was still covered by sea.

Between Rochester and Scottsville, the undulating surface consists entirely of drift, containing numerous boulders of Potsdam sandstone, labradorite, gneiss, hypersthene-rock, &c., from the Laurentine chain about 100 miles off. Many of them are large, smooth, and well striated. Mr. Hall observed that the drift is here often 120 feet thick, and that the mounds are steepest to the north.

The River Genesee runs through a deep rocky ravine, which near Portage is 350 feet high. The rock on the top is smoothed and scratched, and along the whole course of the river, on either side above the gorge, the rocks are generally obscured by drift. On this river Dr. Bigby observed fragments from Montreal Mountain, which lies 270 miles to the north-east ; and Laurentine boulders are common. I observed at Mount-morris, on the river, that in the lower part of the drift the stones are often angular and scratched, while the upper beds are of sand.

Near Portage, on the Genesee, the drift is said by Mr. Hall to be about 500 feet thick, filling up a

valley in the rocks, through which an older river ran previous to the drift-period. When the conntry emerged from the sea, and a new drainage was formed, the river was turned aside by this accumulation finding it easier to form a new channel in the present gorge, 350 feet deep.

At Onondaga the drift is 640 feet thick.

Drift is equally characteristic of Connecticut and Massachusetts. In the New Red Sandstane Valley of Connecticut, the drift seemed mixed, but mostly local.

It is also well known that large far-transported boulders occur on the south bank of the Ohio,—a circumstance less remarkable than at first sight appears, when we consider that it is stated that icebergs have been seen as far south as the Azores.

Wherever the drift is freshly removed, the rocks are found to be smoothed, striated, and often rounded. On the Isle Perrot, near Montreal, Mr. Billings observed striæ running S.W.; and near Ottawa, by the river, in several places they run south-easterly. These instances are both at low levels; and during a late period it is easy to understand how, during a former extension of the Gulf of St. Lawrence, icebergs drifting up the Gulf, as they do now, would produce scratches running S.W. in the strait between the Laurentine hills and the Mountains of Adirondack, while in the open sea south of Ottawa (now a great plain) the drift passed in an opposite direction. About halfway between Ottawa and Prescott, on the St. Lawrence, near Kempville, the striæ runs S. from 5° to 10° E. on a smoothed surface of Calciferous Sandrock; and at Niagara, on the limestone, S. 30° W., with minor striations crossing each other at various angles. Near Avon, at Conesus Outlet, in the Genesee Valley, on the Corniferous Limestone, the chief striæ run S. 10° W., crossed by many minor scratches, having a general southern course. These crossings might be expected, if the striæ were produced by floating ice subject to minor variations of the currents, and to the influence of winds. The rock is overlaid by clay containing scratched subangular stones. At Genesee, under 6 feet of drift-clay full of scratched stones, the striæ run S. 5° W.; and near Portage, on the top of the gorge, 350 feet deep, the striæ run a little west of south.

The rocks of the St. Lawrence, where it flows from Lake Ontario, deserve more special notice. Above its junction with the Ottawa, the banks of the St. Lawrence are low and shelving, and the rocks are in general obscured by drift; but between Brockville and Lake Ontarío, where the river widens and winds amid the intricacies of the Thousand Isles, while the larger islands are

partially covered with drift, and well wooded, the lower islets are often only scantily clothed with grass and a few stunted trees and shrubs. Some of them are formed of Laurentian gneiss, and others of Potsdam sandstone. The Potsdam sandstone above the river-bank at Brockville has been ground smooth, and in waving lines passes under the river. The islands formed of Laurentian gneiss or Potsdam sandstone present the same largely mammilated surfaces, rising from the midst of the river, which between Brockville and the lake gradually increases to 9 or 10 miles in width. All of them are *moutonnées*, somewhat like the islands of Loch Lomond; and the surfaces of the little islets often slip under the water quiet smooth and unbroken.

This is one of those cases in which it might be contended that the glaciation of these rocks may be due to the floating ice of the river when it breaks up in spring. But though it may produce slight effects, there are several conclusive reasons why the greater features should not be referred to this cause. The old glaciation has passed up the country quite beyond the reach of the present river, while the tops of most of the islands rise far above the extreme height of the water; and again, some of the islands with well-rounded glaciated surfaces present vertical cliffs in the river, sometimes 20 feet in height, where the rocks have split away at the joints; and on these cliffs I observed no sign of that glaciation which we should expect to find if the river-ice exercised any important influence. Further, it was observed by Sir Wm. Logan, that if the smoothing were produced by river-ice, many of the trees of the islets would be shaved off by the yearly ice,—whereas, when untouched by man, they grow to the water's edge. At the only place I landed (a wooding-station), the rock had been too long exposed to the weather to retain its striations; but as we passed the islands, I could see indications of striæ; and it is to be wished that some one would settle the point by determining their exact bearings, the chief directions of which, without presumption, I venture to predict will be *across* the river, and approximately from north to south.

Drift and Striæ in the Valley of the Hudson, including the Canaan Hills.—On the banks of the Hudson, south of Albany, the rocks frequently show the familiar mammillated surfaces,—the striations, where I observed them, running nearly north and south. The Highlands of the Hudson also, on a smaller scale, recall the well-rounded outlines of the Laurentine Chain; and at the mouth

of the river numerous *moutonnées* surfaces strike the eye, while boulders strew its sides and the surface of Staten Island in the harbour of New-York,—all attesting, thus far south, the undiminished energy of glacial action.

Near Boston, gneissic rocks show the same signs; and at Roxbury, on the outskirts of the city, large surfaces of perfectly *moutonnée* Red Sandstone conglomerate were pointed out to me by Dr. Gould, who informed me that, when he first took Agassiz to the same spot, he at once recognized their ice-smoothed character. The water-worn pebbles of quartz have been ground quite flat on their upper surfaces, and stand slightly out from the rock, the softer sandy matrix of which has yielded to the influence of the weather.

The same kinds of indications are strong in all those parts of Massachusetts, New Hampshire, and Vermont, through which I passed. There, as in the other places previously mentioned, the country is much covered with clay, sand, gravel, and boulders, partly rounded and apparently chiefly derived from neighbouring formations. Far transported boulders may be more scarce among these mountains, their height having partly barred the transport of floating material from the Laurentine Chain, whereas the broad plains south of the lakes were more open to the ice drifting from the north. In the above-named States, instances of fresh and of decaying ice-worn and striated rocks are of constant occurence in the low ground; and it is truly marvellous to see the same rounded contours rising in the mountains to the very top,—again reminding the traveller of the ice-moulded surfaces of the south-west of Ireland, of the Highlands of Scotland, and of part of Wales. In none of these American localities are there, however, any signs of pre-existing glaciers, such as are frequent in the mountainous parts of the British Isles.

I am unable to throw any new light on the perplexing question of the glacial phenomena of the Canaan Hills. These have been described by Dr. Hitchcock and Sir Charles Lyell. The range lies on the east side of the Hudson, about twenty miles south-east of Albany, and forms part of the Green Mountains, which are an intermediate part of the long chain that, commencing on the south with the Alleghany Mountains, trends north-easterly to the Mountains of Notre-Dame and Gaspé, on the south shore of the Gulf of St. Lawrence. In the District of Canaan and Richmond, their average strike is nearly north and south, the rocks consisting of that part of the Silurian series which ranges between the

Birdseye and Trenton limestones and the Oneida conglomerate,—highly disturbed, cleaved, and partly metamorphosed and foliated. The contours of the hills indicate the moulding effects of ice. The rounded surfaces, wherever they have not been too long exposed to the weather, are grooved and scratched; and these well-defined indications are found alike on the sides and the summits of the hills. In company with Mr. Hall and Sir Wm. Logan, I ascended the Canaan Hills from the N. W., descended into the opposite valley, crossed the Richmond Hills above the Shakers' Village, and, descending into the Richmond Valley, walked to Pittsfield. It is a remarkable circumstance, recorded by Dr. Hitchcock, and partly confirmed by Sir Charles Lyell, and which I also saw, that on both slopes the observed striations run, more or less, *across* the trend of the hills, which at this point strike about N.N.W. The directions of the striæ are between E. 10 ° S. and S.E.; a larger proportion approaching the first than the second direction. Why they should run *across* the hills and valleys at all has not yet been explained; for while quite admitting the value of Mr. Darwin's explanation *, it yet does not appear to me to meet a case where the hills are so steep and the valleys so very deep. The difficulty is increased by the fact that the average strike of mountain and valley is from N. to S., which is also the general direction of glacial striations over most of North America; and it is difficult to understand why, if floating ice produced these marks, an exception should have been made in this case, where we might expect the N. and S. run of the submerged valleys would have acted as guides to the icebergs, which would then have floated from north to south as they did in the adjacent valley of the Hudson. The drift is often 40 feet thick and upwards, and is mostly local, many of the boulders being of the Birdseye limestone, which crops out in the valleys. Smaller drift, with these boulders, creeps up the flanks of the hills almost to their summits,—this effect, as stated by Sir Charles Lyell †, having probably been produced in the manner indicated by Mr. Darwin, who, in a similar instance, considers boulders to have been floated up on the ice of successive winters, by little and little during a slow submergence of the country ‡.

* Phil. Mag. August 1855.

† Proceedings of the Royal Institution, vol. ii. p. 95.

‡ If before the submergence of the country the cold were sufficiently intense, it is possible that each minor range forming the sides of valleys

The Catskill Mountains.—On the west side of the Hudson, the Catskill Mountains rise, in their highest peaks, about 3600 feet above the sea, and nearly that height above the river, which is tidal far above Albany. The strike, both of the Silurian and Devonian rocks of the lower hills, is nearly north and south; and after traversing a broken country for ten or twelve miles, the Catskill Range itself rises in a long north and south escarpment, nearly 3000 feet above the hilly ground that lies between it and the river. At the town of Catskill, striations on the smoothed surfaces run nearly north and south, following the trend of the Hudson Valley between the Catskill and Green Mountains; and at other points between the river and the mountains they run about N.N.E. I was anxious to discover if on the Catskill Mountains themselves there were any signs of true *glacier-action*, this range being much higher than any other elevations which I had an opportunity of ascending. The low country is as much or even more glaciated than Anglesea; and the mountains are as high as Snowdon; and—though in latitude 42° N., whereas North Wales is in latitude 52° to 53°—other conditions seemed very much the same. Observations also in this region were of more importance, since I am not aware that evidences of any kind of glaciation on these heights had previously been definitely recorded. The accompanying sketch-map (fig. 3), constructed on the spot, will give an idea of the topography of that part of the range which I examined.

I ascended from the mouth of the valley misnamed "Sleepy Hollow," up the steep and winding road to Mountain House. The mountain is almost everywhere covered by dense wood, so that, except on the roadside, it is comparatively rare to find the

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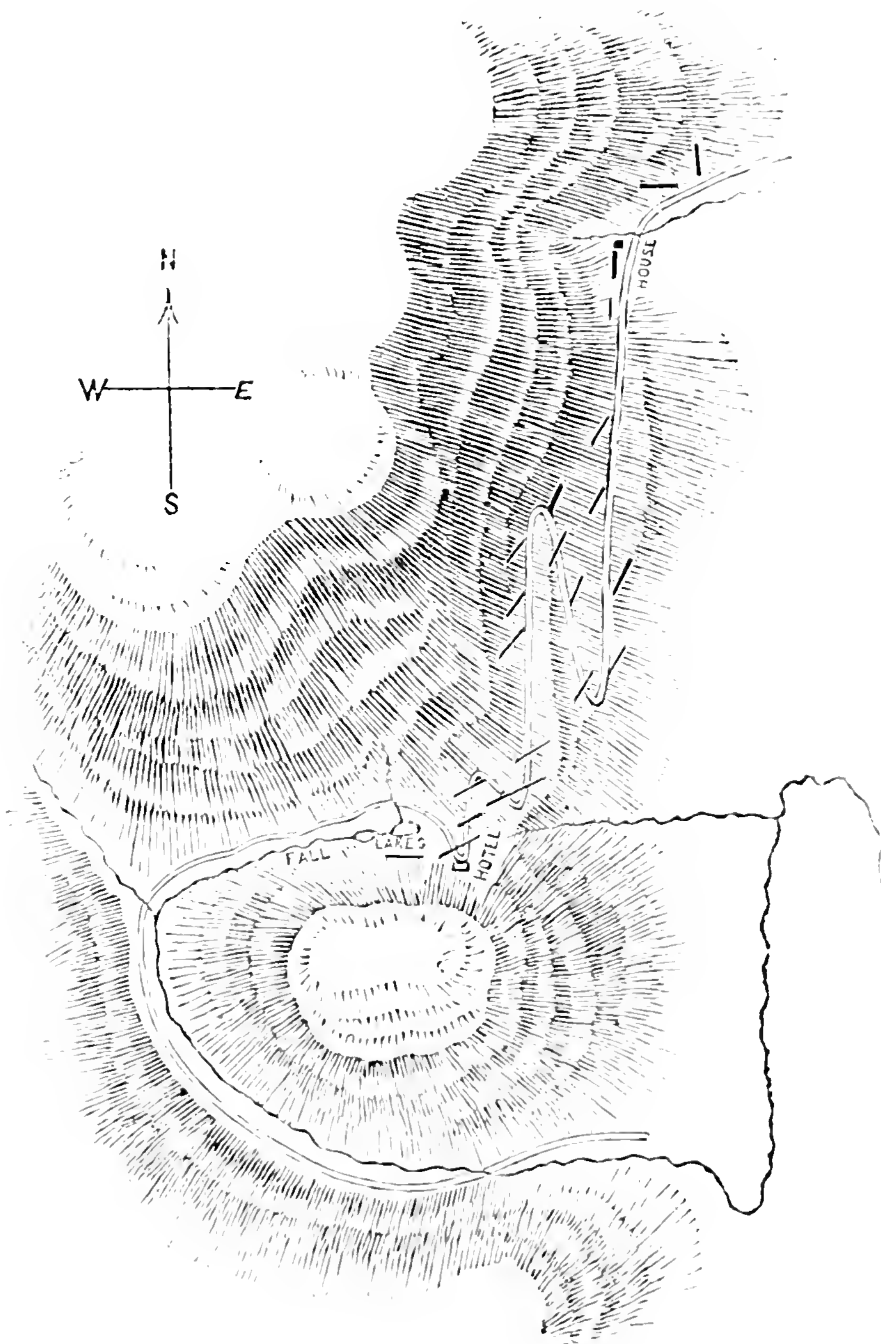
may have been so completely covered with thick snow and ice, that, always pressing downwards from the snow shed, the striations were formed E. and W., or transverse to the trend of the ranges; but in that case both in the valleys and on the sides and summits of the hills, when fairly submerged, we might expect north and south striations formed by the grating of bergs during the deposition of the northern drift. In the case of isolated hills the striæ ought also to radiate from their summits. I observed none of these appearances, but had not sufficient time to search for them in detail. It is clear that the E. and W. striations across the range were not made by a general terrestrial glaciation during, or after, the re-elevation of the country, for then the boulders, &c. transported from low to high levels would all have been swept down again into the hollows.

rocks uncovered. In "Sleepy Hollow" the road runs nearly east and west. Occasionally local drift lies on its steep northern side; and on the smoothed surfaces of rock I observed a few striations from N. to S., and others from E. to W. The former ran up and down the hill towards the brook; and the latter were on the *vertical* faces of the little cliffs, up and down the valley.

Passing the bend where the road crosses the brook, striations became frequent; and I was surprised to find that all of them ran nearly N. and S. along the flanks of the escarpment, and not from W. to E. down the slope of the hill. For a time I thought that as I ascended higher they would cease altogether; but, so far from this being the case, I was alike pleased and astonished

Fig. 3.—*Sketch-map of a portion of the Catskill Mountains, showing the Directions of the striæ near Mountain House.*



to find that they continued equally strong and frequent up to the plateau on which the Hotel stands, 2850 feet above the sea; *and all, but a few of the last, ran not across, but along the face of the escarpment.*

By twenty compass-observations made on clearly defined striations the chief grooves run between S. 22° E. and S. 55° W. Among these, one runs S. 22° E., two S. 10° E., two N. and S., one S. 10° W., six S. 22° W., one S. 30° W., two S. 55° W., and one W. 10° N. The variations seem somewhat connected with bends and other irregularities in the face of the great escarpment, One of the observations (S. 55° W.) was made on the well-scratched plateau on which the Hotel stands, about 120 feet above the lower part of a gorge which here crosses the watershed towards the lakes. in which the stream rises that, further down, forms the Falls of Catskill. The other is at the bend of the road N. E. of the hotel, near the head of the stream. In the lowest part of the gorge, on the summit of the watershed, many square yards of smoothed rock are exposed a little off the road; and in this plateau numerous main grooves are seen, passing *across* the hill, and nearly at right angles to most of those observed during the ascent, seemingly pointing to the fact that the icebergs, which striated the eastern flanks of the mountains in a N. and S. direction, when the whole was nearly submerged, here found a passage or strait, through which they sometimes floated and grated the bottom in a direction quite across that which they were forced to follow when passing along the great escarpment that now faces the Hudson.

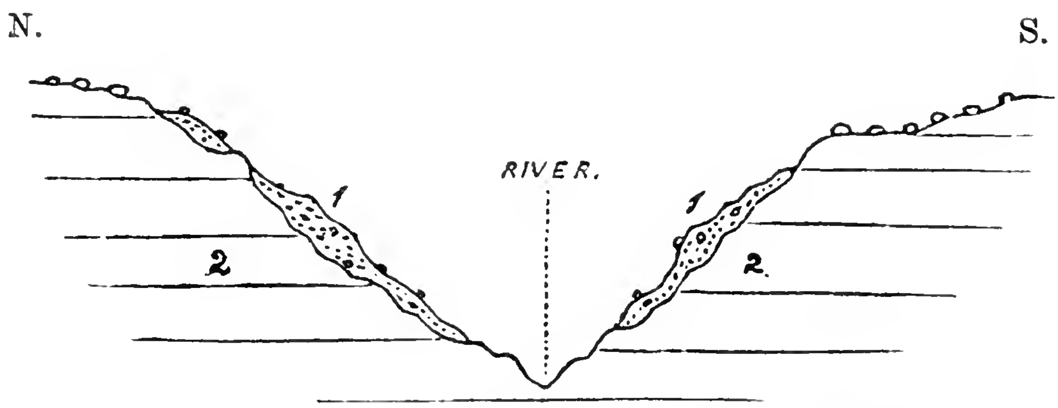
Though the principal grooves run in the directions stated, many minor striations, such as might be expected from floating ice, cross them at various angles.

From this point I made two excursions into the higher parts of the range, in the hope of finding similar markings: but so dense is the forest, that it took two hours to walk a mile: and though in several places the rocks were exposed, they were too much weather-worn to afford all the usual indications. Nevertheless the rounded contours of all mountain-tops always impressed me with the idea of glacial abrasion; and if, as I believe, they were contoured and striated by floating ice, then the drift-sea of the Hudson Valley was at least 3000 feet deep,—and probably more, if, as is likely, the higher peaks were also submerged. Judging by the general uniformity that seems to have prevailed over North America in changes of level, it would probably be safe to infer that this

submergence also extended to the Laurentine and other mountain-chains in the eastern part of North America.

Allowing that the striations on the eastern flank of the great range were made by floating ice, it still does not follow that in the interior there should be no traces of glaciers in the narrow valleys on the opposite watershed,—such glaciers, if they ever existed, being like some of those in North Wales, of later date than the emergence of the country from the drift sea. I had an opportunity of testing this. In the gorge close to the south shore of the little lakes, the striations still run W. 10° N.; and below that point the valley, descending westward from 5° to 10°, is covered with boulders of Catskill sandstone (see fig. 3). About a mile and a half down, at the Falls of Catskill, the valley suddenly deepens; and about two miles further it curves round to the S. E. and finally the stream escapes from the Catskill Range, and flows towards the Hudson. On either side the valley is bounded by high steep slopes and abrupt cliffs; and the height and form of the ground is such that, under

Fig. 4.—*Section of the Valley below the Falls of Catskill, showing boulder-drift covering its sides.*



1. Drift. 2. Red Sandstone and Conglomerate.

favourable circumstances, it seemed as well adapted for the formation of a glacier as many of the valleys of North Wales, had the conditions for such a result been alike propitious. But the evidence is opposed to any such conclusions. I saw no well-marked *roches moutonnées*, no traces of moraines; and the forest-clad slopes are mostly covered with deep local gravel and boulder-drift, many of the stones in which are scratched. Had a glacier existed there since the drift-period, the drift would have been ploughed out of the valley by the glacier, in the manner that it was removed by the glaciers of the Passes of Lanberis and Nant Francon in North

Wales; whereas nothing has been removed, except a portion of the drift by the torrent that now flows in the bottom* (see fig. 4).

Probable equivalency of the Drift of the Hudson Valley with that of Lake Champlain and of Montreal.—I have now a few remarks to offer on a part of the drift itself. South of Albany the Hudson flows through a broad valley full of minor undulations, between the Catskill and the Green Mountains. On the banks of the river are extensive beds of sandy clay, from which the bricks are made of which Albany is built. The city stands on this clay which extends far down the river towards New York, and northward into the Valley of the Mohawk, and as I shall show, probably also into the valley of Lake Champlain. Beyond the river-bank it stretches E. and W. on the undulating ground towards the mountains, rising, six miles in the direction of the Helderberg, far above the level of the river. At its edge, Mr. Hall pointed out to me that the sands, gravels, and boulder-clay of the ordinary drift pass under it. The superficial deposits of the valley of the Hudson therefore, consists of two subdivisions: first, the older boulder-beds; and, second, the laminated clay, which at Albany is a thick formation, finely and evenly bedded in layers of 1 or 2 inches thick, the argillo-arenaceous laminæ of which graduate into each other in shades of bluish-grey, brown, and brownish-yellow, producing a beautifully ribanded aspect, and giving the impression of a succession of repeated alternations of tranquil depositions in still water. Boulders occur in it rarely; and the top is covered with sand, which may possibly represent the uppermost sandy beds of the St. Lawrence and Ottawa districts. I searched in vain for fossils, both in the paper-like laminæ of clay, and in the abundant concretions, resembling those of the valley of the Ottawa which contain the fossil fish *Mallotus villosus.*

The Hudson runs nearly straight north and south; and forty miles above Albany, at Sandy Hill, the Champlain Canal joins the river to Lake Champlain, which also trends north and south, and, separated by a low watershed, lies in what must be considered a continuation of the valley of the Hudson. The lake is 90 feet above the level of the sea; and on the Vermont shore, 150 feet above the sea, there is a section of six feet and a half of regularly

* I was informed by Professor Agassiz, that in the White Mountains, which rise more than 6000 feet above the sea, there are in the higher regions distinct indications of ancient glaciers; and if this be the case, the same phenomena may be looked for in the mountains of Gaspé.

stratified clay and sand, overlying an older blue clay (the older drift), in which were found, by Prof. Zadoc Thompson, *Sanguinolaria fusca*, *Mya arenaria*, *Saxicava rugosa*, *Mytilus edulis*, and the bottom the bones of a Cetacean associated with *S. Rugosa* and a *Nucula* or, more probably, *Leda*. The Leda clay of Dr. Dawson, at Montreal, is also about 120 feet above the river, or 140 feet above the level of the sea. If the so-called "*Nucula*" of Lake Champlain be *Leda Portlandica*, the Montreal beds contain the same assemblage of fossils (except *Sanguinolaria fusca*).* In the Montreal beds Sir Wm. Logan also found a number of the caudal vertebræ of a Cetacean. The beds at Green's Creek, Ottawa, containing the same assemblage of shells, *Mallotus villosus*, and remains of Seals, are 118 feet above Lake St. Peter, and 140 to 150 feet above the sea. Marine shells (*Saxicava rugosa*, *Mya*, *Mytilus edulis* and *Tellina Grœnlandica*) occur at Kingston, at the entrance to Lake Ontario. Dr. Dawson shows good reason why the above-named fossiliferous deposits on the St. Lawrence and Ottawa should be considered equivalents. In addition, I am of opinion that this conclusion may be extended to the Kingston beds, and that the beds of Lake Champlain leading down to those of the Hudson are of the same date; and if so, then I cannot doubt that the laminated clay that overlies the older boulder-drift of the Hudson Valley is a large development of the same formation, the whole having been deposited at the close of the drift-period. In that case, a long marine strait filled the valley of the Hudson, and communicated with the sea that, according to Dr. Dawson, then occupied the whole of Lower Canada south of the Laurentine Chain, and, stretching westward, covered the area of Lake Ontario, and washed the great Niagara escarpment which formed its southern coast.

Probable date of the origin of Niagara Falls.—It has been shown by Mr. Hall and Sir Charles Lyell, that when the Niagara escarpment rose above the water, the Falls of Niagara began by the drainage of the upper lake-area falling into the sea over the edge of the escarpment above Queenstown and Lewistown. It is not improbable that Lake Erie extended at that period much further towards the present falls; and, agreeing in the general conclusions of these observers and of Dawson, it follows that if the sea of the Leda-clay washed the base of the escarpment, *the Falls of Ni-*

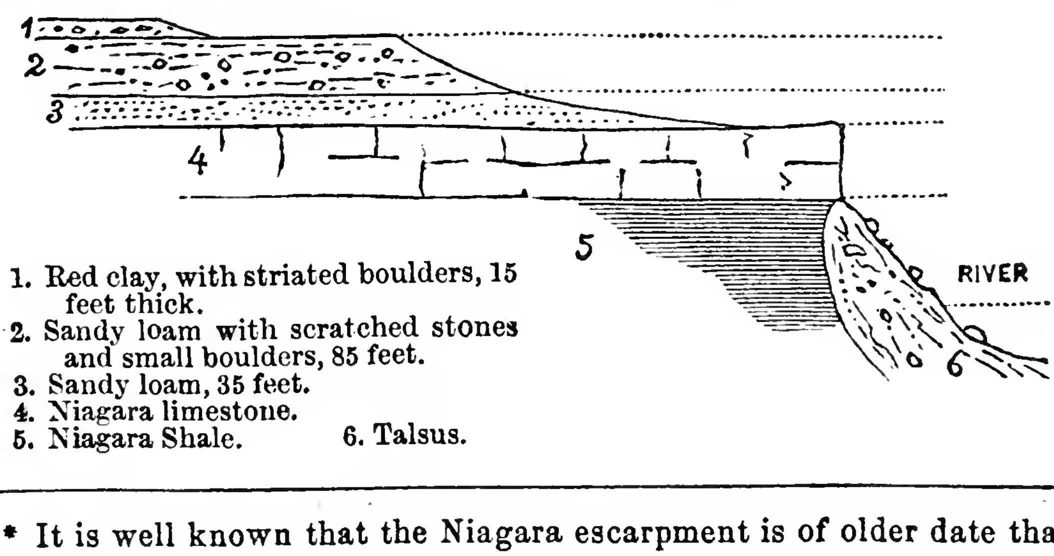
* This is without doubt a Synonym for *Tellina Grœnlandica*, a common shell at Montreal. Ed.

*agara commenced during the deposition of that clay, or a little before the close of the drift-period.** If, with accumulated data, the rate of the past recession of the Falls be actually determinable, we shall then be in a condition approximately to show the actual number of years that have elapsed since the close of the North American drift. It may perhaps appear that the approximate period of 35,000 years, given by Sir Charles Lyell for the erosion of the gorge, is below the reality.

Drift and other Late Tertiary deposits at Niagara.—I have little to add to the account of the late Tertiaries of Niagara given by Sir Charles Lyell and Professor Hall.

Above the falls a terrace of drift with boulders forms the left or Canadian bank of the river. Just before reaching the Horse-shoe Fall, the terraced bank recedes; and a plateau of Niagara limestone lies between it and the edge of the gorge. A road, with a deep cutting in the drift, ascends the slope on the left between Table Rock and Clifton House, at right angles to the river. First there is a gentle slope of 35 feet, then a rapid scarped rise of 85 feet, and behind the railway a second low terrace. The first and second slopes, 120 feet high in all, consist of sandy loam (Nos. 3 and two in fig. 5), scratched stones and small boulders; and the upper terrace (No. 1) is formed of 15 feet of red clay, thinly stratified, also containing angular boulders and scratched stones

Fig. 5.—*Section of the Latter Tertiarg beds near Niagara Falls.*

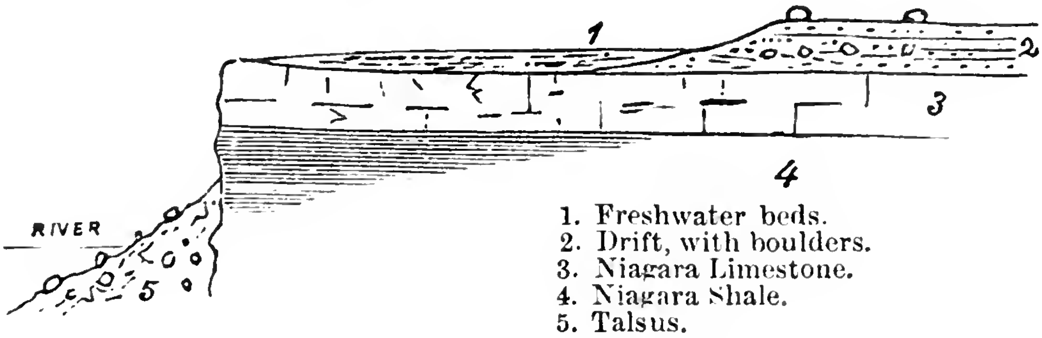


* It is well known that the Niagara escarpment is of older date than the drift. Lake Erie is 329 feet above Lake Ontario; and the older boulder-drift lies indifferently on the lower plain and on the table-land. No one has yet attempted to show at what period this old coast-cliff, about 400 miles in length, was formed. The upper platform, on a grand scale, bears the same physical relation to the rocks of Lake Ontario, that Oolitic escarpment and table-land in England does to the Lias and plains of New Red Marl below.

of Laurentine gneiss, and of Niagara limestones and other Silurian rocks. The top of the upper escarpment of drift forms the highest part of the whole plateau. Being 135 feet above the edge of the fall, its top is 60 feet above Lake Erie, which is only 70 feet above that edge. The edge of the great escarpment above Lewiston is said by Mr. Hall to be 70 feet above the top of the fall; and therefore the escarpment No. 1 of the accompanying diagram (fig. 5) is also 65 feet, and No. 2, 50 feet higher than the top of the escarpment above Lewiston, and 45 feet above Lake Erie. If this drift once extended across the space now occupied by the gorge, as shown by the dotted lines, Lake Erie may originally have extended thus far, and after a time the river gradually cut out a channel in the drift and formed both terraces; or else an original terraced channel existed, formed during the emergence of the country, the terraces being formed by marine denudation.*

The lower terrace has, in part at least, been excavated by the river, which, before the formation of the gorge, here spread into a broad reach, like that above the Falls. It is on a continuation of this platform, about a quarter of a mile below Clifton House, between the drift-terrace and the edge of the gorge, that the strata containing existing river-shells occur (fig. 6).

Fig. 6.—*Section showing the position of the Freshwater beds above the Gorge of the Niagara.*



1. Freshwater beds.
2. Drift, with boulders.
3. Niagara Limestone.
4. Niagara Shale.
5. Talsus.

This drift-terrace Sir Charles Lyell has shown to be as old as the Mastodon-period. The freshwater beds lie in a shallow hollow on the limestone. They consist of remodelled drift, and some of

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* It deserves to be stated, that half-way up the cutting, on the surface, I found a *Cyclas;* and another was found by Sir Wm. Logan, with whom I measured the section, on the same terrace, behind Clifton House. Some bits of plate of the "willow-pattern," however, lay near my shell; and that found by Sir Wm. Logan was on ground that had been stirred with the spade; and we came to the conclusion that the evidence they afforded was of very doubtful value.

the stones are scratched; but whether the scratches made in the older drift-period have not been worn away, or whether the stones were scratched by river-ice is uncertain. The floor of Niagara limestone is here deeply furrowed, the striations and minor scratches crossing each other at various angles; but the majority run S. 30° W. They follow the general direction of the other striations of the country, that underlie the drift.

On Goat Island, Sir. Wm. Logan and I observed that the fluviatile strata lie on drift,—a circumstance, I believe, not previously noticed. It consists, at the base, of sand; and above, of clay horizontally and evenly bedded, containing scratched stones and boulders. As shown in Sir Charles Lyell's diagram*, at the eastern end of the island the Niagara limestone rises a few feet above the river, in the still recesses of which are numerous living shell-fish. Between this and the summit of the island overlooking the Falls, there is a gradual fall of 15 feet, showing the slope of the river-bed when Goat Island was covered with water. The drift at this point is 29 feet thick, and the freshwater beds above 10 feet, giving 39 feet for the height of the island above the water at the edge of the Falls. Allowing a dip of 25 feet in a mile for the general dip of the limestone, Goat Island was covered with water when the Falls were probably about one mile and a half further down than at present. With regard to the retrocession of the fall, as might be expected, its rate is fastest when the body of falling water is greatest, this cause of waste being far more powerful than the winter's frost. Towards the base of the edges of the Horse-shoe Fall, and the American Fall, blocks of limestone are accumulated in great heaps, while in the middle of the Horse-shoe Fall the turmoil is so great that it scoops out the shale beneath so deeply that the great fallen blocks are lost in the abyss. Where the body of water is small in the American Fall, the edge has only receded a few yards (where most eroded), during the time that the Canadian Fall has receded from the north corner of Goat Island to the innermost curve of the Horse-shoe Fall.

* Travels in North America, vol. i. p. 20.

ART. XXVI.—*On Ozone.* By CHARLES SMALLWOOD, M.D., LL.D., Professor of Meteorology in the University of McGill College, Montreal.

[Continued from page 169.]

The method now almost universally adopted for ascertaining the presence of ozone in the atmosphere is from its action on the iodide of potassium and starch. A portion of the iodine is set free by the action of the *oxygen* and combines with the starch, giving rise to the fine blue colour so distinctive of the presence of ozone. The test papers are prepared by boiling one drachm of pure starch in one ounce of distilled water, and when cold, by adding ten grains of the iodide of potassium. This solution is to be carefully and evenly spread upon good *glazed* paper by means of a soft brush, or a sponge may be substituted. I have found that "*glazed*" or "*sized*" paper is preferable to bifulous paper. "*Cream-laid letter-paper*" is that used here—the solution is more evenly spread over the surface. It is then to be quickly dried, cut into pieces of about 4 inches long by 1 inch broad, and kept in a dry place, free from light and air, until required. Schonbein's ozoneometer consists of 750 slips of such paper, which is sufficient for a year. I have found that strips of fine calico, being previously well washed, and then dipped into the solution, answer equally well. I have been in the habit of using them here thus prepared, when long lengths were required, as in the apparatus where time becomes an element of the observation. These strips of paper are exposed to light, free from sun or rain, and are removed at 6 A.M. and 10 P.M., daily. These hours are adopted so as to correspond with the other instrumental observations. The date and hour is inscribed upon them, and the variable amount of ozone indicated is estimated by comparison with a scale of tints. The zero (°) of this scale, or ozoneometer as it is called, is perfectly white, increasing gradually, until a *very deep blue* or *really black* shade is obtained, which is denominated 10; the intermediate shades are easily estimated. The mean of these *two* daily observations forms the daily mean. The deep shades in the ozoneometer, although kept from light and air, are subject to changes by gradually becoming lighter; but a scale of artificial tints may be used, which will be permanent. Dr. Moffatt of England, who has devoted many years to observation on ozone, encloses his slips of paper in a small box without a bottom, so as to keep it shaded from *light* as well as rain. Observations were carried on

here for some years, both by Schonbein and Moffatt's method, for the sake of comparison, but the difference was found so small as not to affect the computations and general results; and the observations are now confined to those of Schonbein, and as being the form more generally adopted, more especially on the Continent of Europe. The test papers require to be moistened with water to bring out the colour. The strips of ozonized paper may be laid in a shallow vessel of water for this purpose, and the ratio of shade or colour is easily estimated.

Exposure causes the ozonized paper to become at first of a pale straw colour, which increases to the tint of dried leaves, then deep brown, or dark violet, approaching to black, which becomes blue by wetting,—or should there be a great amount of moisture in the atmosphere, it at once attains its blue colour, which becomes brown as it dries; but the blue colour may again be brought out by moisture, or re-wetting: this may be owing to the formation of a new quantity of the iodide of starch. It will be necessary in pursuing observations, that care should be taken in the preparation of the *ozone* paper, and that the prepared paper should be placed in a situation near the instruments that are used for observing the atmospheric changes; and it would be well, while carrying out these experiments, that slips of paper should also be placed in different situations, from which might be drawn useful inferences and comparisons. Five feet from the surface of the soil have been adopted here as the *standard* altitude, being sufficiently removed from the effects of terrestrial radiation and moisture, and of a convenient height; but observations are also taken at the surface, placed among plants, over drains, in the sick-chamber, and in other localities, and such observations would seem of great interest towards the due investigation of the effects and properties of ozone on the health of individuals and of plants. Observations have been also recorded here, shewing the effects of the different coloured rays of light, and also polarized light, on the amount of ozone, and also the effects of germination on its development.

It would also be well to pay especial attention to the amount before, during, and after thunderstorms, and also after any great display of the Aurora Borealis, to establish if possible any connections it may have with the amount of atmospheric electricity. It should also be particularly observed during the prevalence of any epidemic, and also during any "*blight*" or defective vegetation; and, when convenient, it would be advisable to shew the

hourly amount by means of a very simple apparatus, moved by an ordinary clock at the rate of 1 inch per hour. The ozone-test thus constructed consists of strips of calico, about an inch wide, moving over a slit in a closed box, so that the *time* of the greatest amount is thus indicated, and may be compared with advantage with the diurnal changes in the atmosphere, as indicated by the barometer's oscillations, temperature, moisture, and the direction and changes of the wind ; and I am led to believe that this method is the only one which will ever give decided results, by thus making *time* an element of the observations.

[To be continued.]

ART. XXVII.—*Fossils of the Calciferous Sandrock, including those of a deposit of white limestone at Mingan, supposed to belong to the formation.* By E. BILLINGS.

(Extracted from the Report of the Geological Survey of Canada for 1858–1859.)

The following paper contains notices of all the species of organic remains that have been collected in Canada up to the present date from the Calciferous Sandrock, including a deposit of white limestone, supposed to belong to the formation. This white limestone has been observed only at the Mingan Islands, where it overlies the Calciferous Sandrock, and is in its turn overlaid by the Chazy. Twelve species have been collected in this rock, and of these, only three occur in the true Calciferous Sandrock, but none of them have yet been found in the Chazy.

Of the forty-one species noticed in this paper, none have been clearly identified with those of the Chazy or any more recent formation, although several of them, such as *Eunema prisca*, *Pleurotomaria calcifera* and *P. Laurentina* are closely allied to species of the Black River limestone. It is not certain that the siphuncles I have referred to *Orthoceras multicameratum*, belong to that species. Future discoveries may possibly prove to the contrary, but, according to our present knowledge, the fauna of the Calciferous Sandrock in Canada is almost entirely distinct specifically from that of the Chazy.

ZOOPHYTA.

PETRAIA MINGANENSIS.

At Romain's Island, one of the Mingan Islands, several fossils have been collected, which appear to be casts of the interior of the cup of a large species of *Petraia.* The specimens are cylindrical, obtusely pointed, and slightly curved at one end. They are deeply striated longitudinally as if by the sharp edges of the radiating lamellæ of a coral of the genus *Petraia.* There are from five to seven striæ in the width of three lines, and therefore, in a specimen one inch and-a-half in diameter, there must have been about one hundred and twenty radiating septa. They appear to be the casts of the interior of a coral, in which the cup extended nearly to the base. In *Petraia profunda,* (Conrad) the characteristic species of the Black River limestone, we have an analagous form in which the depth of the visceral cavity is nearly equal to the total length of the coral. Although it is not yet quite certain that these fossils are the casts of corals, yet, as their form and so much of the structure as is indicated by the markings of the surface render it highly probable that such are their relations, I shall provisionally place them in the genus *Patraia.*

The specimens to which the above description refers are from three to seven inches in length, and about one inch and a half in diameter, but there are fragments that must have belonged to individuals at least two feet long and more than three inches in diiameter.

Locality and Formation.—Mingan Islands in the Gulf of the St. Lawrence, Calciferous Sand-rock.

Collectors.—Sir W. E. Logan and J. Richardson.

STENOPORA FIBROSA* (Goldfuss, sp.)

Small cylindrical stems, several inches in length, and from three to five lines in diameter. They are, I have no doubt, specimens of *Stenopora fibrosa,* although I have not been able, as yet, to detect the cells. They are replaced by chert.

Locality and formation.—Mingnan Islands, Calciferous Sand-rock.

Collectors.—Sir W. E. Logan, J. Richardson.

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*This species has been heretofore called ***Monticulipora dendrosa*** by me. On comparison I do not think we can distinguish it from ***Stenopora fibrosa,*** the European form. It is the branched variety of ***Chætetes lycoperdon*** figured in the Palæontology of New York.

CRINODIDEÆ.

Fig. 1—*m*—*n*.

A fragment of a crinoidal column, two lines in diameter, composed of thin joints, of which there are six in two lines. The joints vary slightly in thickness alternately, and the edges of the thicker ones project a little, so that the column is not smooth, but annulated. The central canal is obscurely pentagonal, or nearly circular. See Fig, 1—*m*, *n*.

Locality and formation.—Mingan Island, Calciferous Sandrock.

Collectors.—Sir W. E. Logan, J. Richardson.

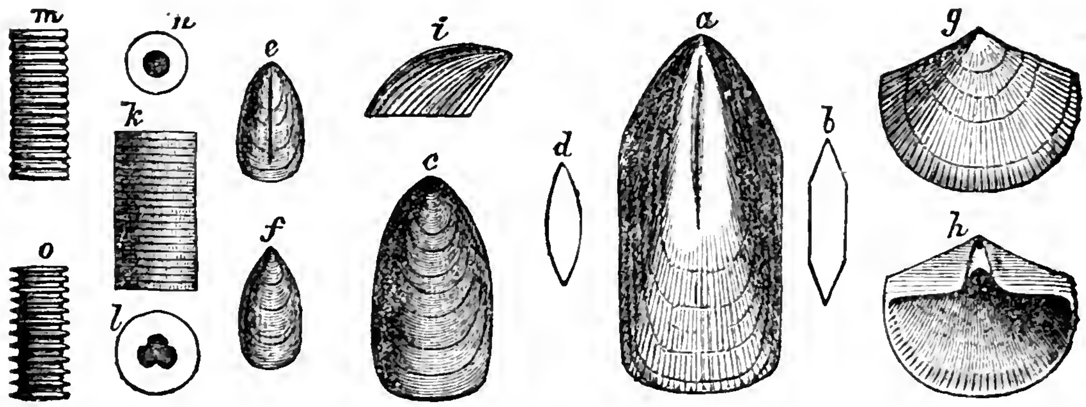

FIG. 1.

a *Lingula Lyelli.*
b Transverse section of *L. Lyelli.*
c Young specimen of *L. Lyelli.*
d Transverse section.
e—*f* *Lingula Mantelli.*
g *Orthis grandæva*, ventral valve.
h Inside of same.
i Side view.
k—*o* Crinoidal columns.

Fig. 1—*o*.

A Column two lines in diameter, composed of large and small joints, the former thin and widely projecting as in that portion of the *Glyptocrinus ramulosus*, which is next to the cup. I think that this is the column of a species of *Glyptocrinus*. See Fig. 1—*o*.

Locality and formation.—Mingan Islands, Calciferous Sandrock.

Collectors.—Sir W. E. Logan, J. Richardson.

Fig. 1—*k*, *l*.

A smooth circular column, three lines in diameter, composed of thin equal joints, of which there are ten in three lines. The central canal is trilobed. See Fig. 1—*k*, *l*.

Locality and formation.—Mingan Island, Calciferous Sandrock.

Collectors.—Sir W. E. Logan, J. Richardson.

These fragments indicate three species of Crinoidea, and they are probably distinct from those that occur in the Chazy or any other overlying formation.

BRACHIPODA.

Lingula Lyelli. (N. s.)

Fig. 1—*a, b, c, d.*

Description.—Elongate-oval or sub-pentagonal; front margin straight or gently convex; sides nearly straight and parallel in the lower two-thirds of the length, above which they converge and meet at the beak at an angle of about forty-five degrees. Both valves are moderately, but not regularly convex, there being a flat triangular space extending from the beak along the centre to the front, and a similar flat space on each side sloping to the lateral margins, and thus each valve is composed, as it were, of three plane surfaces. In the small specimens these planes are not so distinctly indicated as they are in the large ones. The surface is marked with fine concentric lines, and also with longitudinal radiating striæ, the latter being scarcely visible except when the shell is partly exfoliated. Length of large specimens, thirteen lines, width about half the length.

This species is closely allied to *L. parallela*, (Phillips)* but has not, so far as we can judge from the inspection of a single figure, so obtuse a beak. The size and proportions are the same as those of *L. ovata*, (Mr. Coy)† but in that species the longitudinal radiating striæ curve outwards, so as to cut the lateral margins nearly at right angles, while in this they are straight, and thus, form acute angles with the edges of the shell.

This species is dedicated to the distinguished geologist and philosopher, Sir Charles Lyell.

Locality and formation.—Alumette Island, Calciferous Sandrock.

Collector.—Sir W. E. Logan.

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* Memoirs of the Geological Survey G. B., vol. 2, part 1, page 370, pl. 26, fig. 1.

† Mr. Coy. British Palæozoic Fossils, page 255, pl. 1 L, fig. 6. *L. ovata* appears to be a Lower, and *L. parallela* an Upper Silurian species.

LINGULA MANTELLI. (N. S.)

Fig. 1—*e, f.*

Description.—Elongate-oval, sides sub-parallel, gently convex for rather more than half the length, then gradually curving to the beak, front moderately rounded. Surface, when partially exfoliated, covered with longitudinal radiating striæ. Length four or five lines, width rather more than half the length. Both valves are very convex, and do not appear to have the plane surfaces of *L. Lyelli.*

Although the form is somewhat like that of the young specimens of *L. Lyelli*, yet it is clear that this is a distinct species. It occurs in a different locality, and although very abundant, none of the specimens are more than six lines in length, the average size being from four to five lines. It is a smaller, and also proportionally more convex species than *L. Lyelli.*

None of the specimens that I have seen have the shell well preserved, and I am unable, therefore, to say what the character of the surface may be when perfect.

Dedicated to the late Dr. Mantell, author of the Medals of Creation, &c.

Locality and formation.—Near the Village of St. Eustache, Calciferous sandrock.

Collectors.—A Murray, J. Richardson.

ORTHISINA GRANDÆVA. (N. S.)

Fig. 1—*g, h, i.*

Description.—Ventral valve depressed pyramidal, nearly semicircular, area large, inclined backwards at an angle of about 125°; foramen closed, all except a small space at base, the apex perforated; surface with fine radiating striæ, of which there are four or five in one line at the margin; width of the only specimen seen, at hinge line, seven lines; length, from hinge line to front, three lines and a half; length from beak to front, six lines; height of area, two lines. Dorsal valve unknown.

It is not certain that this species belongs to the genus *Orthisina;* but, as the foramen is nearly closed, it appears more closely allied to that genus than to *Orthis.* A single, but very perfect valve is all that has been collected.

There are, besides the above, in the White Limestone at the Mingan Islands, numerous casts of a species of *Orthis* or *Orthisina,* which have the same form as *O. grandæva,* and appear to

me to be the same species. If so, then the dorsal valve is convex, and the species attains a much larger size than that indicated by the single valve in our possesion. The specimens range from six lines to one inch in width, and are very abundant.

Locality and formation.—Mingan Islands, Calciferous Sandrock.

Collector.—Sir W. E. Logan.

LAMELLIBRANCHIATA.

Conocardium Blumenbachii. (N. s.)

Description.—Triangular, ventricose, sub-cordiform, umbones prominent incurved, the posterior or truncated extremity flattish or gently convex with an oval outline, the greatest width being at about one third the length from the beak; the length from the beaks to the posterior ventral margin in the best preserved specimen is sixteen lines, greatest width thirteen lines. On a side view the form is sub-triangular, the posterior angle rather sharp, about 80°; the ventral margin rounded; the posterior edge or ridge which runs from the beak to the posterior ventral angle is nearly straight or but slightly convex in the lower half and thence becomes more and more strongly curved until it reaches the beak. The anterior side is a little longer than the ventral margin and appears to have been nearly straight. Surface with rather strong radiating ridges four or five in the width of two lines at the ventral edge.

The cast of the interior of the right valve indicates six or seven crenulations on the posterior edge of the shell in the length of two lines.

The siphonal tube is not preserved in any of the specimens but there are indications of its existence. There is a small species of this genus in the Black River limestone but this is the first that has been discovered in strata of such great antiquity as the Calciferous sandrock.

Locality and formation.—Mingan Islands, White Limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

GASTEROPODA.

Holopea turgida, (Hall, Sp.)

Pleurotomaria? turgida, Hall, *Paleont. N. Y., Vol.* 1, *p.* 12, *Plate* 3, *Fig.* 9, 10.

Several specimens have been collected in the Calciferous Sandrock, Mingan Island, which appear to be of this species.

Collectors.—Sir W. E. Logan, J. Richardson.

HOLOPEA OVALIS. (N. S.)

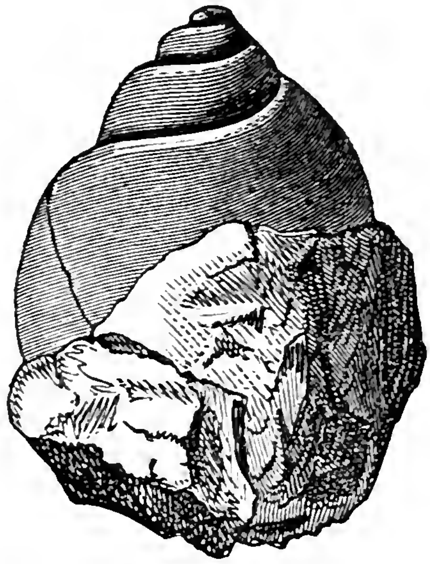

FIG. 2.

Fig. 2.—*Holopea ovalis.*

Description.—Oval, moderately ventricose, four whorls, the body whorl at the aperture occupying two thirds the whole length, the whorls depressed convex, the suture deep,giving the cast a turreted appearance, apical angle about 75°. Length one inch and a half, width fourteen lines.

Locality and formation.—Second Concession of Godmanchester, Calciferous Sandrock.

Collector.—J. Richardson.

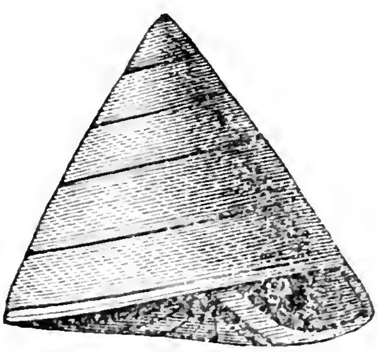

FIG. 3.

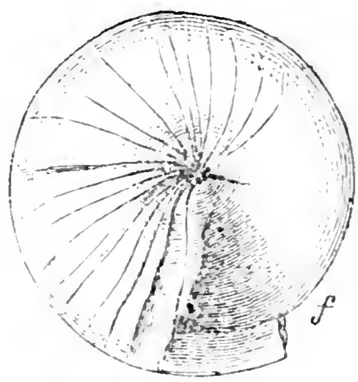

FIG. 4.

Fig. 3.—*Pleurotomaria Ramsayi.*
4.—*P. Ramsayi.* View of base.

PLEUROTOMARIA RAMSAYI, Billings.

Figs. 3, 4.

Description.—Shell trochoid, acutely conical, spire much elevated, whorls five or six perfectly flat, apical angle about 60°. Outer margin of body whorl with a sharply rounded edge; aperture sub-rhomoidal, umbilicus small; surface with fine striæ curving backwards from the upper to the lower edge of the volutions

Base slightly concave. Height of only specimens collected fourteen lines, width of base about the same, width of umbilicus one line.

The spire of this species, owing to the perfect flatness of the whorls, presents at first sight an uniform plane surface, the suture being so fine that it is barely visible. The outer edge of the body whorl shows what may be called a spiral band, which on its upper side is bordered by a fine continuous line, half a line from the edge; the outer angle of the mouth has a moderately deep angular notch as in the other species of this genus; the striæ on the base after leaving the edge curve abruptly forward, and then at the distance of less than a line from the edge rather suddenly change their direction, and with a barely preceptible backward curve proceed to the umbilicus in a nearly straight line; there are several strong wrinkles that follow in the direction of the striæ. The course of the striæ over the edge cannot be distinctly seen but they appear to make a sharp curve backward corresponding to the form of the notch. The upper and outer sides of the aperture are straight, the lower side is also straight for about half the width of the volution, and it then curves up gradually to form the inner lip, a small portion of which is reflected. This species much resembles a *Trochus*, but the notch in the outer angle of the aperture, the direction of the striæ on its surface and the apparent band shew that it is more likely a *Pleurotomaria.*

Dedicated to the eminent geologist Professor A. C. Ramsay, Director of the Geological Survey of Great Britain.

Locality and formation.—Mingan Islands, Calciferous Sandrock.

Collectors.—Sir W. E. Logan, J. Richardson.

Pleurotomaria, calcifera, (N. s.)

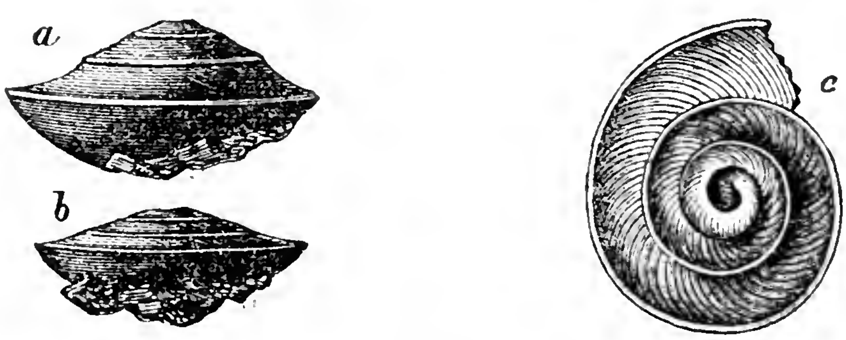

Fig. 5.

a *Pleurotomaria calcifera.*

b A more depressed variety.

c View of the spire shewing the backward curving striæ.

Description.—Lenticular, with a sharp elevated margin; spire much depressed; apical angle varying from 130° to 145°; whorls four or five, rather slender with a thin elevated outer edge which is more or less distinctly visible all the way to the apex; they are also slightly concave on their upper surface, the concavity being deepest near the lower edge; in some specimens there is a gentle convexity in the upper half of each volution and in others the surface is nearly flat. On the under side of the shell the whorls are convex and appear to have a prominent obtuse angle at the edge of the umbilicus; the latter is large, conical, penetrating to the apex and at least half as wide as the whole shell. The surface is covered with fine striæ which turning backward at an acute angle indicate a deep notch in the outer angle of the aperture. The last whorl in some of the specimens on approaching the aperture drops a little below the margin of the second, shewing a tendency to become disengaged. The aperture judging from the form of the volutions must be sub-rhomboidal. The largest specimen seen is one inch and a half wide, and about half an inch in height.

This species is closely allied to *R. aperta* (Salter), but differs therefrom in the following particulars. 1st. The height *R. aperta* is about half the width, in this species about one third. 2nd. In *R. aperta* the edges of the whorls on both sides of the suture sink below the general surface, and there is consequently a rather deep spiral channel running to the apex, but in this species the outer edge of the whorl rises above the general surface and forms an elevated spiral line following the upper side of the suture from the aperture to the apex. 3rd. In *R. aperta* the inner half of the width of the volution is always strongly convex and the outer half as strongly concave but in *R. calcifera* the whole surface of the whorl is concave or only very slightly convex towards the inner side.

As all the specimens that I have seen are embedded in the rock, I have only been able to ascertain the characters of the underside of the shell from fragments. The base seems to be more like *R. aperta* than the spire. The two species are closely allied and should, perhaps, be considered as varieties of each other.

Locality and formation.—Near Beauharnois, Calciferous Sandrock.

Collector.—J. Richardson.

Pleurotomaria abrupta, (N. s.)

Description.—Sub-lenticular, with a broad vertical band beneath the outer edge; whorls four or five, slender, sub-cylindrical, convex above and below. At the upper outer angle of the whorl a rather strong rounded ridge follows all round, and beneath it a flat or slightly concave vertical band, which at the aperture is one line wide in a specimen nine lines in width, below the band, the whorl is regularly convex. The umbilicus is about one third the width of the shell. Surface unknown.

Differs from *R. aperta* and *R. calcifera* in the vertical outer side of the body whorl.

I have seen no perfect specimens of this species but such as we have clearly indicate its distinctions.

Locality and formation.—Mingan Islands, White Limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

Pleurotomaria miser, (N. s.)

Description.—This species is closely allied to *R. abrupta* but differs therefrom in having the lower side of the body whorl sharply augulated in the middle and also in the presence of an obtuse carina about the middle of the upper suface of each volution. Judging from the form of the fragments of the whorls the aperture must be sub-pentagonal. It is evidently a smaller species than any of the others; width of largest specimen seen, five lines.

Locality and formation.—Mingan Islands, White Limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

Pleurotomaria Laurentina, (N. s.)

Description.—Lenticular, spire depressed, whorls five or six, on their upper sides slightly convex, but with a shallow concave band just within their outer margin. The lower side of the body whorl is a little concave just beneath the margin, then moderately convex to the umbilicus within which it is rather narrowly rounded. The umbilicus is deep and one fourth the whole width of the shell. The cast of the interior exhibits an acutely rounded margin, which, owing to the concave band above, appears to be turned a little upward, or to have a narrow ridge all round on its upper side. The aperture is sub-rhomboidal, the inner upper side slightly indented by the penultimate whorl. Width of largest specimen two inches and one fourth, height not

quite half the width in some of the specimens and more than half in others.

Associated with the larger are others almost an inch wide, with the whorls more convex below, but presenting no other differences so far as I have been able to observe. I think they are of the same species.

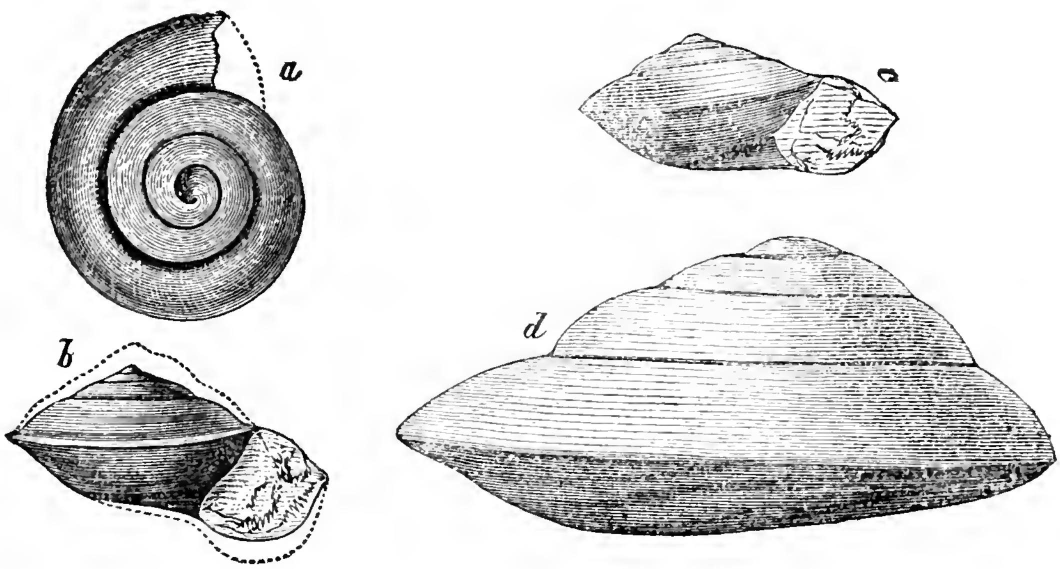

FIG. 6.

a *Pleurotomaria Laurentina.* View of the spire. The specimen is a cast.
b—c Side views of two specimens.
d A large imperfect cast.

This species is allied to *R. lapicida*, Salter, but differs in having the whorls gently convex above, and in the form of the aperture which in that species is acutely oval, while in this it is subrhomboidal. The outer angle of the aperture of *R. lapicida*, measures about 75°, but in this species it is more than 90°.

The two species are most closely related, and it is not improbable that intermediate forms may yet be found to connect them.

Formation and Locality.—Mingan Islands, Calciferous Sandrock and White Limestone.

Collector.—J. Richardson.

PLEUROTOMARIA GREGARIA. (N. S.)

Fig. 8—*h*, *k*.

Description.—Shell, small; spire conical; apical angle about 45°; whorls, three or four, with a very narrow spiral band, which, on the body whorl, is rather above the middle of the volution, but in the upper whorls is situated on the lower outer

side at about one fourth the heighth. In full-grown specimens there is an obscure carina on the body whorl, one fourth of a line above the spiral band, and another close to the suture; the space between these two carinæ is flat or slightly concave; half a line below the band there is a third carina, scarcely visible, and below this the whorl is rounded ventricose. There is a small umbilicus. Length of shell, four lines; greatest width, two lines and a half. Surface minutely striated.

Locality and formation.—St. Anns and near St. Eustache, extremely abundant, Calciferous sandrock.

Collectors.—A Murray, J. Richardson.

TROCHONEMA TRICARINATA. (N. s.)

Description.—Depressed turbinate; whorls, four; with three carinæ, two of which are on the outer edge of the body whorl, and of these one is lost in the suture above. The third carina is on the upper side of the whorl, about the middle, but rather nearer the suture than the outer edge. The spaces between the carinæ, are concave; base depressed convex not carinated.—Width of only specimen collected, nine lines.

At first sight this species appears to be the widely known *T. umbilicata*, (Hall) but differs therefrom by having only three carinæ.

Locality and formation.—Mingan Islands, Calciferous sandrock.

Collectors.—Sir W. E. Logan, J. Richardson.

OPHILETA COMPACTA. (Salter).

O. COMPACTA. (Salter). *Canadian Fossils Decade*, 1, p. 16, pl. 3.

This species occurs near Beauharnois, near the Village of St. Eustache, and also at Romain's Island.

HELICOTOMA UNIANGULATA. (Hall.)

EUOMPHALUS UNIANGULATUS. (Hall). *Palaeont.*, *N. Y.*, vol. 1, p. 9, pl. 3, fig. 1, 1 a.

Occurs at Romain's Island.

HELICOTOMA PERSTRIATA. (N. s.)

Description.—One inch and a half wide; whorls, three or four, with a strong carina on the upper side near the suture, another near the outer margin, and, apparently, several smaller ones below on the outside of the outer volution. The spaces between

these large carinæ with numerous coarse longitudinal striæ following the whorls to the apex. The lower and outer side of the whorls are regularly convex, and the umbilicus one third of the width of the whole shell.

This species is about the size of *H. uniangulata* and also of *H. planulata*, the spire a little more elevated than that of the latter, while the upper surface, in addition to the two keels, is ornamented with the longitudinal spiral striæ, which occur only on the outer side of *H. planulata*, and not at all on *H. uniangulata*.

Locality and formation.—Mingan Islands, White limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

MACLUREA MATUTINA. ? (Hall).

MACLUREA MATUTINA, (Hall). *Paleont., N.Y.*, vol. 1, p. 10, pl. 3, fig. 3.

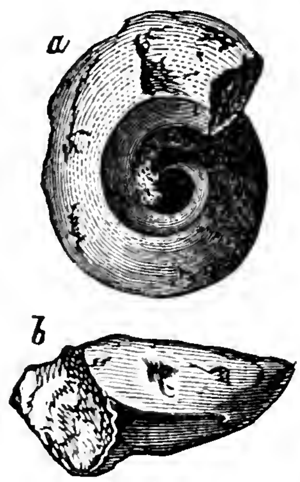

FIG. 7.

a *Maclurea matutina.* Lower side.
b Front view.

The specimen above represented agrees in its proportions very closely with those figured by Professor Hall. On referring to the plate cited, it will be seen that the figure shews two imperfect specimens, a small one with two whorls, and a larger one with nearly three. Ours agrees almost exactly with the smaller and also with the first two whorls of the larger. I think it highly probable that when good specimens can be compared, those of New York will be found identical, and I shall not therefore propose another name for ours.

Locality and formation.—Mingan Islands, Calciferous sandrock.

Collectors.—Sir W. E. Logan, J. Richardson.

MURCHISONIA ANNA. (N. s.)

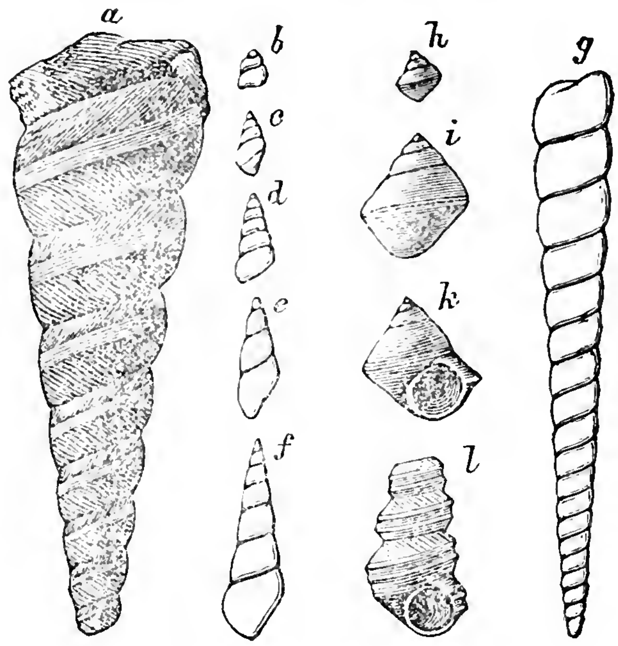

FIG. 8.

a *Murchisonia Anna.*
b—e Small specimens supposed to be of this species.
g *Murchisonia linearis.*
h—k *Pleurotomaria gregaria.*
l *Eunema prisca.*

Fig. 8.—*a*, *d*.

Description.—Elongate, apical angle about 20° ; whorls, ten or twelve, flattened in their upper two-thirds, rounded near to and into the suture. About the middle of the lower half of the whorl there is a narrow flat spiral band, which, on the body whorl of large specimens, is one line or a little more in width, but becomes gradually narrower to correspond with the decreasing dimensions of the upper whorls. The fine striæ are most conspicuous on the upper part of the whorl, their course being from the suture downward, and backward with a sigmoid curve to the band. On some of the specimens there are also numerous undulations in the shell which follow the course of the striæ. Length of full grown specimens, about three inches; but accompanying these there are multitudes of smaller ones of all sizes, from the length of two lines to two inches. Many of these small ones have the whorls nearly regularly convex and may constitute new species; but, at present, I think they are only the young.

This species, especially in the small specimens, somewhat resembles *M. gracilis*, (Hall) but is easily distinguished therefrom by the flatness of the upper part of the whorls. It is more closely

allied to *M. multivolvis* (Billings) which occurs in the Hudson River group at Anticosti; but in that species the whorls are still more flattened in the upper part.

Locality and formation.— At St. Ann's, on the Island of Montreal. Lot 12, con. 12 of the Township of Bagot, in the Calciferous sandrock at the Mingan Islands, in the White limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

MURCHISONIA LINEARIS. (N. s.)

Fig. 8.—*g*.

Description.—Very slender; elongated; apical angle about 10°; whorls twenty or more, convex. Length, two inches or more.

Of this species we have only impressions, but they are sufficient to shew that it differs widely from any other known in the Lower Silurian rocks of this country.

Locality and Formation.—Mingan Islands, White limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

MURCHISONIA ARENARIA. (N. s.)

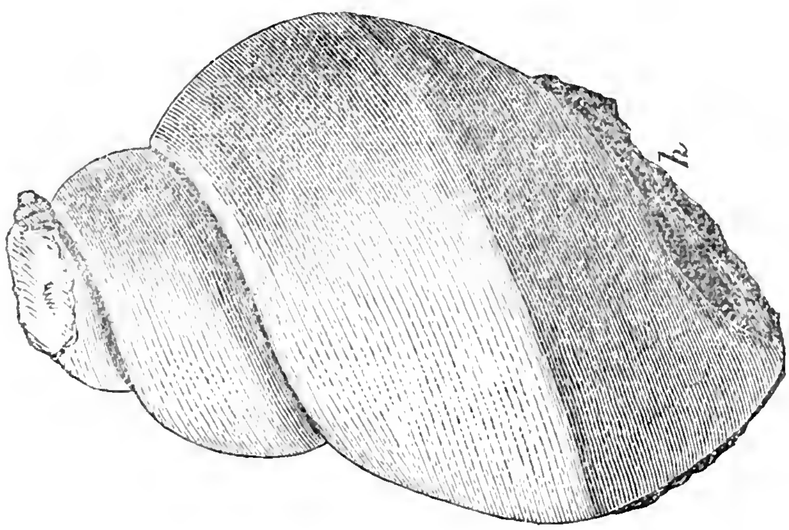

FIG. 9.

Description.—The cast of the interior of this species is conical; apical angle about 50°; whorls four or five, ventricose and obtusely angulated in the middle, where there is evidence of a spiral band. Above and below the band the body whorl is flattened or depressed convex, the upper whorls more evenly convex. Length, apparently, about three inches; width of body whorl, two inches.

The cast of this species somewhat resembles that of some of

the varieties of *M. bellicincta.* (Hall) but the spire is shorter and the whorls more angulated in the middle.

Locality and formation.—Lot No. 12, con. 12 Godmanchester, Calciferous sandrock.

Collector.—J. Richardson.

SUBULITES CALCIFERA. (N. s.)

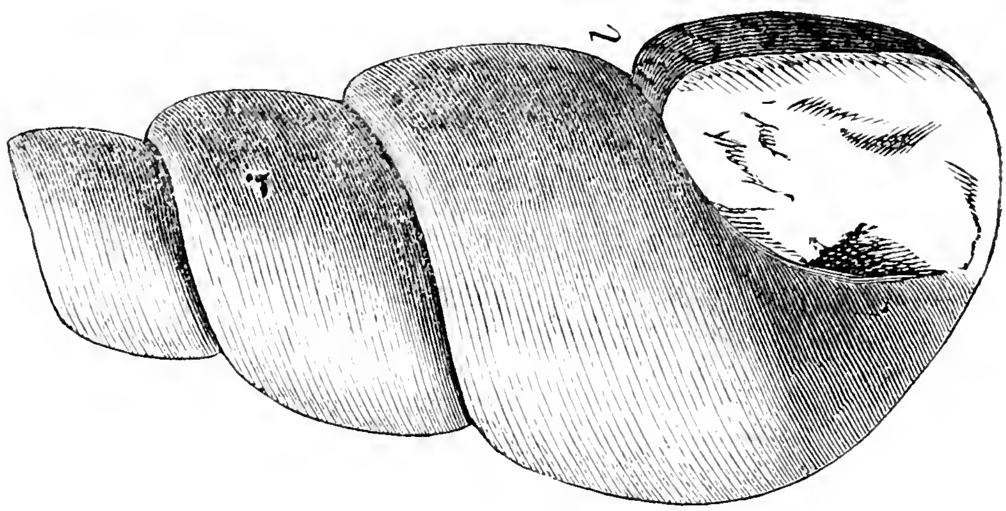

FIG. 10.

Description.—Elongate; apical angle about 20°; whorls five or six; depressed convex, or nearly flat in the middle; length, four or five inches; width of body whorl about fifteen lines. Each whorl is about one-third shorter than the one preceding it.

This species, in its form and in the proportional length of the whorls, very closely resembles a species that occurs in the Trenton. It appears to be more like a *Loxonema* than a *Subulites.*

Locatity and formation.—Mingan Islands, Calciferous sandrock.

Collectors.—Sir W. E. Logan, J. Richardson.

EUNEMA PRISCA. (N. s.)

Fig. 8.—*l.*

Description.—Elongate; slender apical angle about 12°; whorls ten or twelve, each with two sharp keels in the middle, above and below which the surface descends with a gently concave slope to the suture. Length, from one inch and a half to three inches; width of body whorl in a specimen, nearly three inches long five lines; width of spiral band, three-fourths of a line.

This species is only distinguishable from *E. pagoda* (Salter) by having no third keel near the suture.

Locality and formation.—Mingan Islands, Calciferous sandrock, and White limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

CEPHALOPODA.

Genus ORTHOCERAS, (Breyn).

The Orthoceratites of the Calciferous Sandrock and Chazy, have the same aspect as a group, and appear to be numerous, but are usually in a very bad state of preservation. Most of them

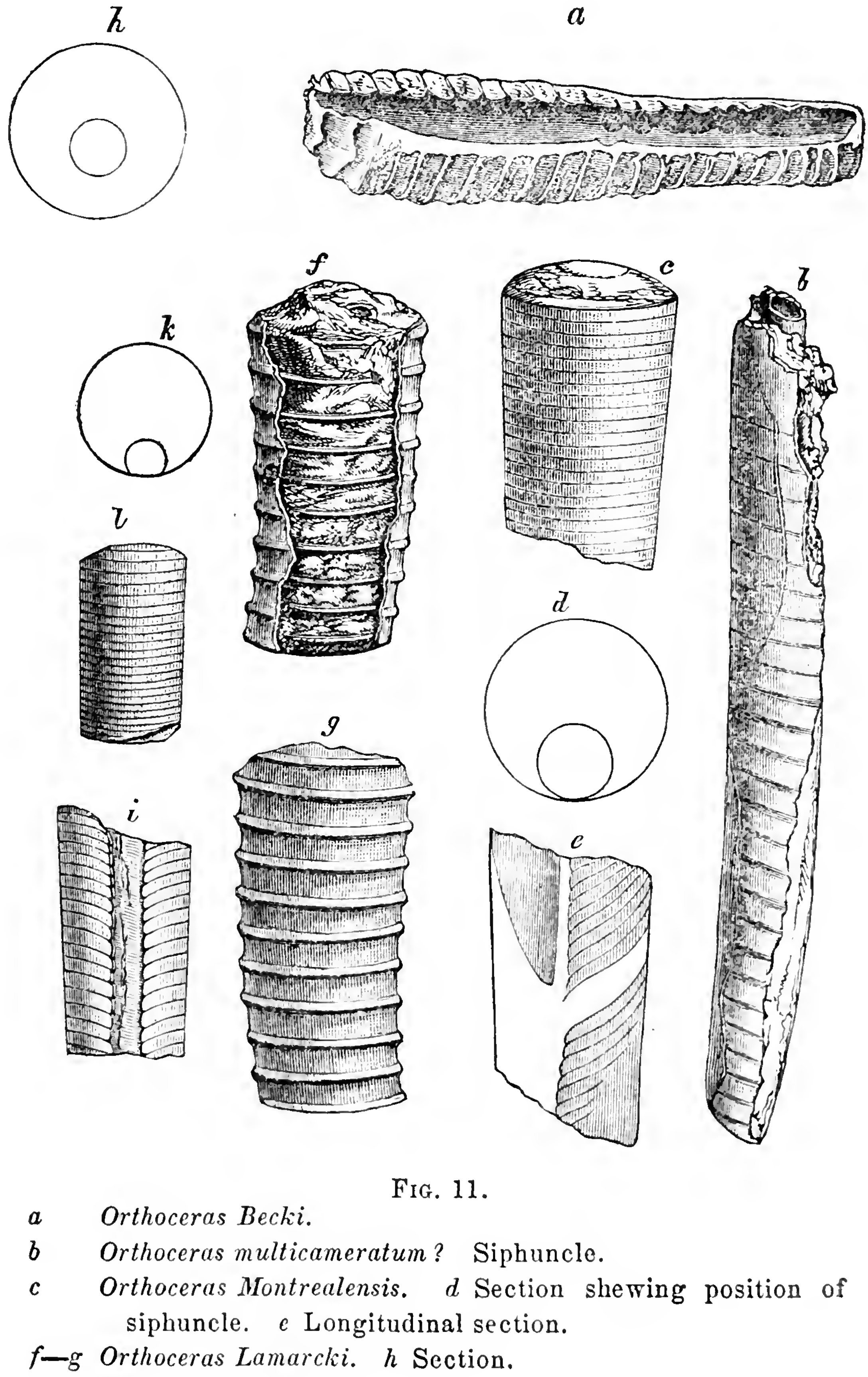

FIG. 11.

a *Orthoceras Becki.*
b *Orthoceras multicameratum?* Siphuncle.
c *Orthoceras Montrealensis.* *d* Section shewing position of siphuncle. *e* Longitudinal section.
f—g *Orthoceras Lamarcki.* *h* Section.
i—k *Orthoceras sordidum.*
Orthoceras deparcum.

are more or less curved and have large siphuncles, and several are remarkable for the close approximation of their septa.

ORTHOCERAS LAMARKI, (N. s.)

Fig. 11.—*f*, *g*, *h*.

Description.—Annulated, tapering at the rate of about one line to the inch, section circular, septa gently convex, eight in one inch at a diameter of eight lines, more numerous towards the apex, siphuncle cylindrical a little excentric, its diameter full one third the diameter of the whole shell. The annulations are rather prominent rounded ridges with regularly concave spaces between, distant one line and a half from each other in a specimen eight lines in diameter.

The specimen figured is silicified, and it is impossible to say whether the surface is striated or not. Three specimens have been collected and all are a little curved.

The septa increase rapidly in number towards the smaller extremity of the shell and it would appear also that in some individuals the distance is variable. In one specimen where the diameter is five lines, there are five septa in half an inch, but in the next half inch there are eight.

The position of the siphuncle is also a little variable.

Resembles externally the large curved *O. subarcuatum*, (Hall) of the Chazy limestone, but that species has more distant septa and a siphuncle composed of large oval bead-like segments.

Locality and formation.—Occurs at the Mingan Islands, and also on Lot 12, Con. 12, Township of Godmanchester, Calciferous Sandrock.

Collectors.—Sir W. E. Logan, T. Richardson.

ORTHOCERAS BECKI, (N. s.)

Fig. 11.—*a*.

Description.—Section circular, smooth, slightly curved, tapering at the rate of one line and one fourth to the inch; septa rather convex, nine to the inch at a diameter of seven lines; siphuncle cylindrical nearly marginal one third the whole diameter.

This species is allied to one that occurs in rocks of the same age in Scotland, figured in 3rd Edition of Siluria p. 217.

Locality and formation.—Mingan Islands, Calciferous Sandrock.

Collectors.—Sir W. E. Logan, J. Richardson.

ORTHOCERAS MONTREALENSIS, (N. s.)

Fig. 11.—*c*, *d*, *e*.

Description.—Section circular, smooth, tapering at the rate of about one line to the inch : septa very convex, eighteen or twenty to the inch at a diameter of eight lines; siphuncle cylindrical marginal seven sixteenths the whole diameter of the shell surface unknown.

Locality and formation.—Near the village of St. Eustache, Calciferous Sandrock.

Collectors.—J. Richardson, A. Murray.

ORTHOCERAS MULTICAMERATUM ? (Conrad.)

Fig. 11.—*b*.

Several siphuncles have been collected in the Calciferous Sandrock at the Mingan Islands, which appear to be of this species. Specimens with the shell and septa preserved, occur at the same locality in Chazy limestone immediately overlying the rocks in which these siphuncles were collected.

ORTHOCERAS DEPARCUM, (N. s.)

Fig. 11.—*l*.

Description.—Section circular smooth, tapering about half a line, and with thirty-two septa to the inch at a diameter of five lines. Siphuncle unknown.

This species tapers more gradually than *O. Montrealensis* and has the septa more approximated. *O. primigenium*, Conrad, is an allied species but with about forty septa to the inch according to the figure in the Palæontology of New York.

Locality and formation.—Mingan Islands, White Limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

ORTHOCERAS SORDIDUM, (N. s.)

Fig. 11.—*i*, *k*.

Description.—Cylindrical, apparently a little curved; septa convex about twenty to the inch at a diameter of half an inch; siphuncle marginal a little less than one third the diameter of the whole shell.

Resembles *O. Montrealensis* but is a more slender species and has the siphuncle smaller.

Locality and formation.—Mingan Islands, White Limestone.
Collectors.—Sir W. E. Logan, J. Richardson.

Genus PILEOCERAS, (Salter.)

Mr. Salter has informed me that he intends to describe under the above generic name some remarkable fossils that have been found at Durness in Sutherlandshire Scotland, where they occur associated with *Ophileta compacta* and others allied to species of the Calciferous Sandrock and Chazy limestone. A species of the same genus has been collected in this country, but lest any confusion should take place I shall not describe it until I can see Mr• Salter's paper.

Genus LITUITES ?

There are two species apparently of this genus in the Calciferous Sandrock, but the specimens are so imperfect that they cannot be sufficiently characterised.

CRUSTACEA.

Genus BATHYURUS, (New genus.)

Generic Characters.—Trilobites of a medium size, oblong oval; head thorax and pygidium sub-equal; facial suture in front of the eye nearly parallel with the longitudinal axis of the body, reaching the anterior margin and behind the eye dividing the posterior margin; glabella sub-clavate conical or cylindro-conical usually prominent and without lobes, but sometimes with several obscure lateral transverse sulci, divided behind by a neck furrow; hypostoma oblong not forked, somewhat oval, an elevated margin around the posterior two thirds in some of the species, muscular impressions two, transverse or oblique, situated behind the middle; thorax in the species in which it has been observed with nine segments; pleuræ grooved.

The above genus is proposed to include serveral species of Lower Silurian trilobites of which *B. extans* (Asaphus extans, Hall), may be regarded as the type. It should perhaps be considered as a sub-genus of *Asaphus* of equal value with *Megalaspis* (Angelin) from which it differs in the form of the head and pygidium and in the number of the segments of the thorax. I shall give some further illustrations of the genus hereafter.

I have provisionally referred the following species to *Bathyurus*•

BATHYURUS AMPLIMARGINATUS, (N. S.)

Fig. 12, *a*, *b*.

Description.—The pygidium of this species is nearly semi-circular its length being only a little more than half its width; the axis is elongate conical very prominent and distinctly defined all round, its length about two thirds, and its greatest width one fifth that of the whole pygidium; it is crossed by five distinct transverse furrows but the terminal one third is either smooth or marked by extremely obscure sulci. On each side of the axis there are five ribs; the first of these is only partly preserved in the specimen, the second at about half its length contracts to one half its width and appears to become obsolete before reaching the margin; the third rib is in length equal to the width of the axis at the point where it is attached; the fourth a little shorter, while the fifth is simply a triangular convex space between the fourth furrow and the posterior third of the axis. The most striking character is the broad smooth margin, the width of which is about one fourth that of the whole pygidium.

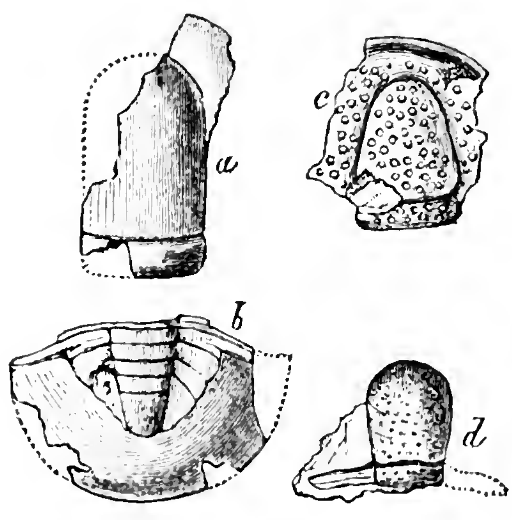

FIG. 12.

a—b *Bathyurus amplimarginatus.*
c *Bathyurus conicus.*
d *Bathyurus Cybele.*

Associated with this pygidium and in the same mass of stone was found the glabella represented by Fig. 12, *a*. It is depressed cylindro conical, length eight lines, width four lines and a half, a strong neck segment one line and a half in width.

Locality and formation.—Mingan Islands, White limestone.

Collectors.—Sir W. E. Logan. J. Richardson.

BATHYURUS CYBELE, (N. s.)

Fig. 12, *c.*

Description.—Of this species the glabella only has been found It is slightly clavate being a little wider near the front than it is at the neck furrow ; it is convex, with an elevated rounded front; two obscure barely visible lateral sulci not reaching the centre; one of these furrows is at about one third the length from the neck furrow, and the other at two thirds ; they slope forward and outward at an angle of about 55° ; the neck furrow is deep concave, and with a forward sinus in the middle. The surface is covered with small tubercles. The front of the glabella is slightly produced into an obtuse scarcely visible, rounded lobe one third the whole width. Length nearly five lines, width four lines.

Locality and formation—Mingan Islands, White limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

BATHYURUS CONICUS, (N. s.)

Fig. 12, *d.*

Description.—Glabella conical rather strongly convex, with a deep neck furrow and a deep sulcus all round, covered with small sharp tubercles distant from one fifth to two fifths of a line from each other. In the specimen a small portion of the anterior margin of the cephalic shield in front of the glabella is preserved. It seems to shew that the whole head was surrounded by a deep marginal furrow. Length of glabella including neck segment five lines and a half; width at neck segment four lines. The most striking features are the regularly conical shape of the glabella and the tubercular surface. The margin in front of the glabella is two lines wide.

In the same rock and near the same locality, the cheek piece of a trilobite was found with a tubercular surface, and with the posterior angle produced into a short spine. It probably belongs to this species.

Locality and formation.—Near Beauharnois, Calciferous Sandrock.

Collector.—J. Richardson.

ASAPHUS ——— ?

A single fragment of a large *Asaphus* was collected at the Mingin Islands in the Calciferous Sandrock.

LEPERDITIA ANNA, (Jones).

L. ANNA, (Jones) *Annals of Natural History*, 3rd series, vol. 1, p. 247, plate ix., fig. 18.

———— *Canadian Fossils, Decade* 3, p. 96, plate xi., fig. 13.

This species has been found only at the original locality in a quarry near the Station House of the Grand Trunk Railway, St. Anns.

ARTICLE XXVIII.—*Descriptions of some new species of Trilobites from the Lower and Middle Silurian rocks of Canada.* By E. BILLINGS.

(Extracted from the Report of the Geological Survey of Canada for 1858-1859.)

ILLAENUS GLOBOSUS. (N. s.)

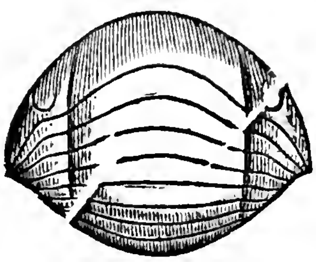

FIG. 1.

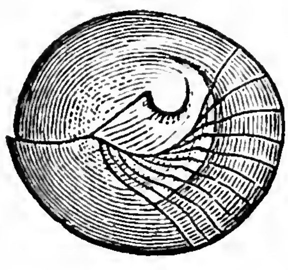

FIG. 2.

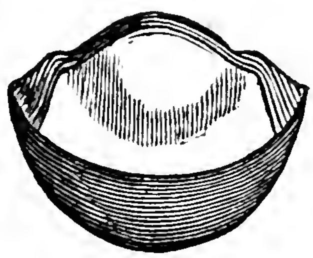

FIG. 3.

Fig. 1.—*Illænus globosus.* View of the thorax of a specimen rolled up.
2.—Side view of same specimen.
3.—View of pygidium of the same.

Description. Oblong, oval, distinctly trilobed, the central lobe very broad, full half the whole width. Length two to three inches, width half the length. Head rather more than one third, the thorax about one third and the pygidium rather less than one third the whole length.*

The head is large, very convex, most prominent in the centre and in form about one fifth more than the quarter of a sphere; the dorsal furrows continued on it about one third the length, sub-parallel, a little curved outwards at their anterior extremities, distant from each other half the width of the whole head; cheek

* All the measurements of the head and pygidium given in this article (unless otherwise stated) were made by placing one point of the dividers at the centre of the anterior, and the other at the centre of the posterior margins. The figures would be different if the length were in all cases taken from the most forward projecting point, and this would be the proper mode, provided we knew how the animel carried its head.

pieces small, the facial suture half way between the dorsal furrow and the genal angle, eye rather small and situated about half its own length from the posterior margin; genal angles broadly rounded.

Thorax with ten segments, axis evenly convex, rather prominent, full half the whole width, about one sixth longer than wide, its sides nearly straight and the width at the first segment slightly greater than at the last; on each side of the axis a very narrow flat space scarcely one sixth the width of the axis, its outer margin forming the line of the fulcra of the pleuræ; the pleuræ are in length equal to about half the width of the axis, at the fulcra they appear to be bent at an angle of about 45°. The segments of the thorax increase in width from behind forwards.

The pygidium is in the extent of its surface about half the size of the head, transversely oval but with its lateral extremities obliquely and largely truncated, the posterior margin broadly and regularly rounded, the front margin trilobed, the central lobe being six eights of the whole width, the axis either not at all or only very obscurely defined.

The surface is smooth with the exception of the front part of the head which is marked by fine undulating concentric fissures about six in one line. The course of the facial suture has not been distinctly observed behind the eye.

Only one specimen with all the parts in place has been collected. It is rolled up and its measurements are as follows. Length of the head following the curvature of the surface one inch, of thorax nine lines and of pygidium nine lines. The proportional lengths of the head thorax and pygidium measured in this way would therefore be $\frac{4}{10}-\frac{3}{10}-\frac{3}{10}$.

But if we measure the parts in a straight line from the middle of the anterior to the middle of the posterior margins, the length of the head is about nine lines, the thorax about eight and the tail a little more than seven.

The width of the head at the eyes in a straight line is one inch nearly; following the curvature one inch and a half; width of axis of thorax about seven lines; length of pleuræ about three lines and a half.

The only described species to which this bears any near resemblance is the well known *I. crassicauda* of Europe but on comparison I find that that species has a larger head, a narrower central lobe to the thorax, the axis of the tail distinctly defined all round

and the whole surface covered with strong undulating wrinkles. The two species although allied and occuring in strata which are most probably of nearly the same age are nevertheless decidedly distinct.

Judging from the figures given in the Palaeontology of New-York I think it probable that neither of the species there referred to *I. crassicauda* are identical with the European form.

The specimen represented on Plate 4 Chazy may be a fragment of a large individual of this species but those on Pl. 60, Trenton, I think are not. I have never seen a fragment of the true *I. crassicauda* in the Silurian of Canada.

Associated with the specimen above figured is the head of an individual of this species that must have been a little more than three inches in total length.

I beg to express my obligations to the Geological Society of London for the loan of a specimen of the true *I. crassicauda* with which to compare this species.

Locality and formation. Mingan Islands, and also Island of Montreal, Chazy.

Collectors. Sir W. E. Logan, J. Richardson.

ILLÆNUS BAYFIELDI. (N. s.)

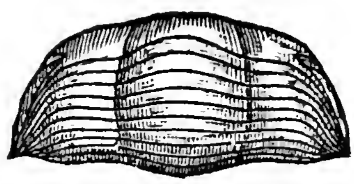

FIG. 4.

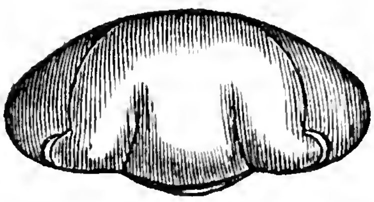

FIG. 5.

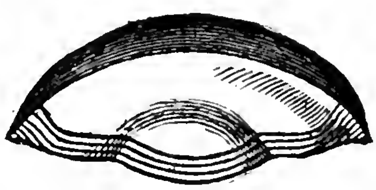

FIG. 6.

Fig. 4.—*Illænus Bayfieldi.* View of the thorax of a rolled up specimen.
5.—View of the head.
6.—View of the pygidium.

Description. Oblong, distinctly trilobed ; length two or three inches; width three fourths the length, central lobe rather more than one third the whole width. Proportional length of head, thorax and pygidium about as 9, 8, 6½.

The head is transversely oval in outline, the width twice the

length, rather evenly convex, most prominent in the centre, the front margin broadly rounded, the posterior margin trilobed by the dorsal furrows which are extended forward to about the middle of the head but are only distinct for one fourth that distance; they at first incline towards each other and then becoming very obscure curve outwards; on each side of the central lobe the posterior margin is nearly straight as far as the eye when it gradually curves forward and outward for one half the length of the head when turning a broad rounded angle it merges into the front margin. In consequence of this peculiar form of the posterior margin the genal angle in this species is in the front half of the lateral margin of the head. The eye is of moderate size lunate and within one fourth of its length from the margin. The facial suture curves forward so as to cut the front margin considerably within a longitudinal line drawn through the eye; behind the eye its course is remarkable as it turns outwards and runs parallel with the margin which it reaches at about three fourths the length of the pleurae. The lower angle of the eye is distant from the dorsal furrow a little less than half the width of the central lobe of the posterior margin. The width of the cheek piece on a line drawn transversely across the head at one third the distance from the eye to the front is nearly equal to half the distance between the eyes. In a vertical view of the head neither the full width of the cheek piece nor the position of the genal angle can be seen as the outline is fore-shortened, consequently in the figure above given the width appears less than it really is.

Thorax of ten articulations, axis of thorax square, the length and breadth being the same, moderately convex, well defined; the fulcra of the pleuræ are at about one third the width of the axis from the dorsal furrow, the intervening space flat.

Anterior edge of pygidium convex at the axal lobe, obliquely truncated from the fulcrum, the axis either not at all or only very obscurely defined.

Surface smooth with the exception of the front of the head where there are at the margin the usual transverse fissures.

This species was discovered by Admiral Bayfield, R. N., during his survey of the Gulf of the St. Lawrence. A well preserved specimen is in the Cabinet of the Geological Society of London among the fossils presented by Admiral Bayfield. During the present year 1859, Sir W. E. Logan visited the Mingan Islands and procured numerous specimens at Trilobite Bay the original locality.

Dedicated to the discoverer Admiral Bayfield.

Locality and formation. Trilobite Bay Mingan Islands, Chazy.

Collectors. Sir W. E. Logan, J. Richardson.

ILLÆNUS AMERICANUS. (N. S.)

Description.—Oblong, distinctly trilobed, length, two or three inches; width about three-fifths the length; proportional length of head, thorax, and pygidium, as 12, 9, 8.

Head large, transversely oblong or sub-oval, length two-thirds the width, convex most prominent in the centre, behind strongly trilobed by wide and deep dorsal furrows, which, towards their anterior extremities have a sigmoid curve inwards and outwards. Front margin somewhat straight or gently convex; posterior margin straight as far as eye and then gently curved forwards and outwards to the broadly rounded genal angle which is situated in the front half of the lateral border. The eye is not well preserved in our specimens, but enough remains to show that it is not more than two lines in length in a large individual, and situated rather more than half its length from the margin; it appears to be prominent, and is situated at a distance from the dorsal furrow equal to half the width of the axis. The facial suture reaches the front margin a little within the parallel of the eye; behind the eye its course cannot be ascertained from our specimens.

Thorax of ten segments; axis a little more than one third the width of the whole animal, moderately convex, when not distorted about one-fourth longer than wide, about one-ninth wider at the first than at the last segment, sides nearly straight.

On each side of the axis there is a flat space between the dorsal furrow and the bend of the pleuræ; the width of this space is rather more than one-third the width of the axis. The pleuræ are bent at the fulcra at an angle of 45° and at a little more than one-third their length from the side of the axis.

The pygidium is comparatively small, its length being only two-thirds that of the head, it is largely truncated at the ends, the two lateral margins thus formed being straight and in length nearly half the length of the whole pygidium; the width of the pygidium is twice its length. The dorsal furrows are strong at the margin but die out at less than one-third the length, and the axis is therefore not defined all round.

The surface is remarkable. On the head it is thickly covered

with short squamose wrinkles, of which there are from six to eight in one line. On the tail these seem to radiate irregularly from the axis as a centre.

This species is related to *I. Bayfieldi*, but differs in its proportions, its head being larger and the axis of the thorax not square, but longer than broad; the eye is more distant and the surface not smooth. *I. crassicauda* has a much larger pygidium, with a conical axis, well defined all round.

Locality and formation.—Trenton Limestone, City of Ottawa. Specimens with all the parts in place rare, as indeed are all the species except *I. Bayfieldi*.

ILLÆNUS CONRADI. (N. s.)

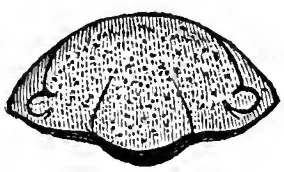

FIG. 7.

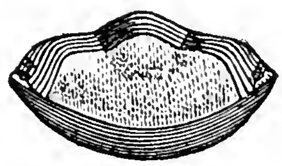

FIG. 8.

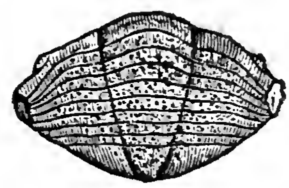

FIG. 9.

Fig. 7.—*Illænus Conradi.* View of the head of a rolled up specimen. The width of the cheek pioces cannot be seen in this view on account of the foreshortning.

8.—*Illænus Conradi.* Pygidium of same specimen.

9.—*Illænus Conradi.* Dorsal view, shewing the 8 segments of of the thorax.

Description.—Oblong, distinctly trilobed, central lobe less than one-third the width at the neck segment, the whole width three-fourths the total length. Proportional length of head, thorax, and pygidium, as $5\frac{1}{2}$, $4\frac{1}{2}$, 4.

Head transversely sub-fusiform, the lateral extremities outside and in front of the eye terminating in obtusely rounded points; width measured from point to point a little more than twice the length; front margin convex along the middle with a gentle broad concave sinus in front of each eye; posterior margin strongly tri-lobed by the dorsal furrows, straight from the furrow to the bend of the pleuræ, then curving backwards to a point behind the eye and thence forward and outward to the lateral extremity. The dorsal furrows are deep and broadly concave at the margin, but become obsolete at about one third the length of the head; they curve a little inwards and they are distant from each other one-third the whole width of the head. The eye is small, sub-globular, abruptly elevated all round the lower, outer and

upper sides, but on the inner side even with the surface; the distance between its outer side and the dorsal furrow appears to be a little variable, but is always more than half the width of the axis of the thorax at the first segment, or about one-sixth the whole width of the head; it is distant from the posterior margin rather less than its own diameter. The facial suture turns outwards and cuts the posterior margin at a point just behind the outside of the eye; it cuts the front margin on a parallel passing half-way between the eye and the dorsal furrow.

Thorax with eight segments, the axis very convex and well defined by nearly straight sides; it gradually tapers so that the width of the last segment is only about two-thirds that of the first. The space on each side between the axis and the bend of the pleuræ is perfectly flat. The bend of the first pleura takes place at one-third its length or half-way between the axis and the parallel of the outer side of the eye, in the last pleura it is a little more distant.

The pygidium is snb-quadrilateral, the front margin straight with the exception of the convex elevation of the axis in the middle third; the lateral extremities are largely truncated, straight, aud at an angle of about 80° with the straight portion of the anterior border; the posterior margin is gently convex. The axis is very prominent in front but becomes obsolete or scarcely at all defined behind. The width of the pygidium is not quite twice the length.

The surface is strongly punctate.

The fragments such as the heads and tails are not uncommon but perfect specimens extremely rare. The following are the measurements as nearly as they can be made out from a single rolled up specimen which has the lateral extremities of the head broken off, but is in other respects beautifully perfect.

Length of head in straight line............	$5\frac{1}{2}$	lines.
——————— following curvature........	7	"
Distance between dorsal furrows...........	4	"
Outside of eye from dorsal furrow..........	$2\frac{1}{2}$	"
Distance of eye from posterior margin......	$\frac{2}{3}$	"
Diameter of eye front to rear..............	$\frac{5}{6}$	"
Length of thorax........................	$4\frac{1}{2}$	"
Width of axis at first segment.............	$3\frac{1}{2}$	"
——————— at last segment..............	$2\frac{1}{3}$	"
Bend of first pleura from axis..............	$1\frac{1}{4}$	"
———— last pleura.......................	$1\frac{2}{3}$	"
Length of Pygidium......................	4	"

Width at front margin....................	$5\frac{2}{3}$	lines.
Between posterior angles..................	7	"
Length of the oblique straight lateral margins which are produced by the truncation of the extremities........................	$2\frac{1}{2}$	"
Total length.............................	14	"

The obtusely pointed angles which form the lateral extremities of the head are as already stated broken off but from the detached head of another specimen it would appear that the distance between the angle and the eye is not quite so great as between the eye and the dorsal furrow.

It is difficult to give a clear expression of the form of a rolled up specimen of a small trilobite by wood engraving and the figures above given do not convey so clear an idea of the form as could be desired.

This species is allied to *Illaenus ovatus* (Conrad) but differs therefrom in the following particulars. Conrad says that his species has the eyes " placed on a line with the angle in the middle of the side lobes " meaning a line drawn along the bend of the pleuræ; in ours they are outside of that line; he also says the middle lobe or axis of the pygidium is " convex, rounded and well defined at the extremity " but in this species it is so obscurely defined as to be barely traceable. We have one nearly perfect specimen of *I ovatus* and in its characters it agrees very well with Conrad's description; it has ten articulations in the thorax, the bend is at full one half the length of the pleuræ; the axis of the pygidium is not only distinct but even abruptly elevated behind; the eyes are totally destroyed in the specimen but their position seems to be that mentioned by Conrad.

In the Palaeontology of New-York, Vol. 1, plate 67 two species are figured under the name of *I. ovatus.* One of these has eight segments in the thorax but Professor Hall says " it has a strong thick spine at the posterior angle of the cephalic shield." I do not think therefore that it can be identical with ours. The other specimen figured has nine segments in the thorax, and the eye outside of the line of the bend of the pleurae but conical and strongly projecting; it also differs too much from ours to be regarded as the same.

Dedicated to T. A. Conrad the first Palæontologist of the New York Survey.

Locality and formation. At the falls of La petite Chaudière, Township of Hull, Black River Limestone.

ILLÆNUS MILLERI. (N. s.)

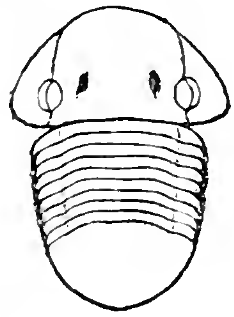

FIG. 10.

Fig. 10.—*Illænus Milleri.* In this figure the head is drawn as if partly flattened out, in order to shew the cheek pieces. The specimen is rolled up. In the natural position the posterior margins of tbe cheek pieces are in contact with the pleuræ. The head and pygidiam are a little foreshortened.

Description. Oblong oval, indistinctly trilobed, length one or two inches, width variable, about two-thirds the length, proportional length of head thorax and pygidium about as 6, 4½, 5½.

Head transversely semioval, evenly convex somewhat abruptly elevated in the front half and more depressed behind, not trilobed, genal angles rounded, eyes moderately large, lunate, less than half their length from the posterior borders, about their own length from the genal angle, and full six eights the entire width of the head from each other. Cheeks rather small, facial suture cutting the front margin a little within the parallel of the eye and the posterior margin just behind the outside of the eye. The dorsal furrows are represented by two obscure not always visible indentations each about one line in width, situated at about one fourth the length of the head from the posterior margin with a distance between them about equal to half the distance between the eyes. These pits are visible on the cast of the interior of the head and constitute a good character for distinguishing it from other species.

Thorax of nine segments; the dorsal furrows represented by two scarcely perceivable longitudinal depressions outside of which the pleuræ bend a little backwards. In well preserved specimens which have not been distorted the line along the bend of the pleuræ is a well defined rounded angular ridge the distance between the two lines being a little less than twice the length of the thorax.

Pygidium a little longer than the thorax, transversely broad oval, depressed convex in the front third, rather abruptly convex

and elevated behind. The front margin is nearly straight or only gently convex in the middle third, then straight, but turned backwards to the ends of the pleuræ, where it meets the posterior margin nearly at a right angle.

Surface smooth.

Allied to *I. Trentonensis*, but in that species the dorsal furrows are continued on the head and in the cast of the interior extend nearly to the front margin, where they terminate in two small circular pits.

Dimensions of a small nearly perfect specimen, not the one figured :—

Total length	14½	lines.
Length of head	6	"
Width of head	13½	"
Distance between eyes	11	"
Length of thorax	4½	"
Distance between the lines of the bend of the pleuræ	8½	"
Length of pygidium	5½	"
Width	8½	"

Dedicated to the late Hugh Miller, the eminent Scotch geologist.

Locality and formation.—This species occurs in the Trenton limestone at St. Joseph's Island, Lake Huron; at the city of Ottawa; at L'Orignal, and at various other localities in the valley of the Ottawa. Also in the Black River limestone, at the Falls of La Petite Chaudiére, township of Hull.

Illænus Trentonensis. (Emmons.)

This species occurs at La Petite Chaudiére, township of Hull, and at the Mingan Islands in the Black River limestone

Illænus ovatus. (Conrad.)

This species occurs at La Petite Chaudiére, township of Hull, in the Black River limestone.

Of the following species, no perfect specimens have been found, but they are evidently distinct from any of the preceding.

Illænus angusticollis. (N.s.)

Description.—Of this species only the head has been found, and the most remarkable peculiarity it presents is the very nar-

row neck-like central lobe, and the depth of the dorsal furrows. The eye is depressed conical or sub-globular, and very like that of *I. Conradi;* the space between it and the dorsal furrow tumid and one-third wider than the central lobe. The front margin of the head is somewhat straight, a little convex along the middle, and slightly concave in front of the eye. The lateral extremities of the head are sharp and nearly in a line with the front margin. The posterior margin is strongly tri-lobed by the dorsal furrows, which are at first sub-parallel or gently diverging as far as the level of the eye ,when they curve outwards, and become obsolete; in the cast they are distinctly marked nearly to the front margin. From the eye the posterior margin is straight and extends outwards and forward to the lateral angles, which are nearly on a line with the front margin. The head is abruptly elevated in front; the central lobe a little more elevated than the tumid space on each side between the dorsal furrow and the eye, but about the centre of the head it is flattened or very depressed convex, a character which distinguishes this species from *I. conifrons.* The facial suture I have not made out. The eye is distant half its own width from the posterior margin, and from the dorsal furrow a distance equal to once and a hird the width of the middle lobe. In a specimen where the width of the head between the two lateral angles is eight lines, the length is three lines and a half, and the width of the dorsal lobe one line and three-fourths.

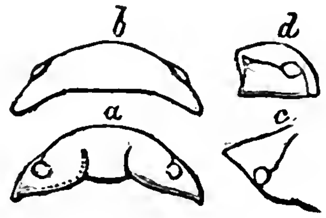

Fig. 10.

Fig. 10.—*Illænus angusticollis.* *a* Back part of the head. *b* Front. *c* Oblique view of one side to shew the pointed front angle. *d* Side view.

The central lobe is finely and closely punctured, the punctures just visible to the naked eye and nearly in contact with each other. The remainder of the head is smooth.

Allied to *I. Conradi*, but in that species the width of the middle lobe is nearly twice the distance between the eye and the dorsal furrow, while in this the distance of the eye is one-third greater than the width of the lobe.

Locality and formation.—Island of St. Joseph, and on the island west of Grant's Islands, Lake Huron; also at the Falls of La Petite Chaudière, township of Hull. Black River limestone or base of the Trenton.

Collectors.—A. Murray. E. Billings.

Illænus conifrons. (n.s.)

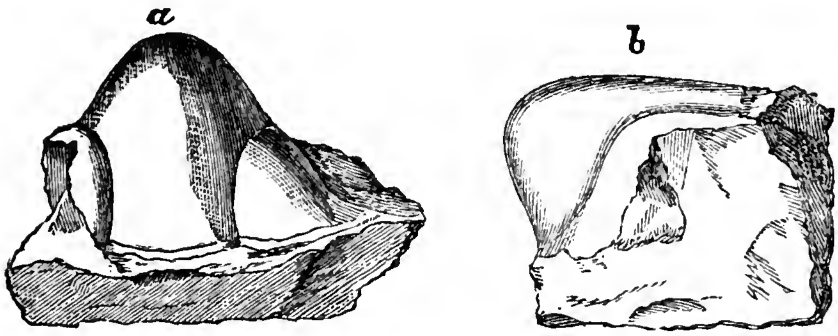

Fig 11.

a Upper surface of head. The dorsal furrows are straight instead of curved, as they are in this figure.

b Side view.

Description.—This species is closely allied to *I. angusticollis*, but differs therefrom by having the glabella or central lobe expanded and elevated so as to form a large conical protuberance on the front half of the head. In the best preserved specimen the head is strongly trilobed behind by the deep dorsal furrows which are parallel and distant four and a half lines from each other for four lines forward, when they curve outward to the width of seven lines, then curving inward they unite in front; the furrow in front of the glabella runs along for five lines at a distance of one line from the margin and parallel with it. This is the appearance of the furrow on the cast of the interior of the head, but it is most probable that when the crust is preserved, it is only obscurely indicated in the front half of the head. The central lobe is very convex, and has the elevation and form of one-third of a cylinder so far forward as the dorsal furrows are parallel; it then expands to nearly twice its width and is conically inflated so as to project forward, and overhang the front margin. On a side view the dorsal outline of the head is nearly straight, or gently convex for the length of seven lines, but in the next three lines it makes a short rounded curve which changes the direction about 100° downwards on which course it continues in nearly a straight line to the front margin. (See Fig. 11.) The height of the most elevated point of the head above the front margin is six lines.

The distance of the eye from the dorsal furrow appears to be at least greater than the width of the central lobe, but how much greater cannot be determined by the specimens yet discovered. The facial suture cuts the front margin on a parallel passing nearer the dorsal furrow than the eye.

Judging from the fragments I have seen, this species must attain the length of two inches. I think also that the eye must be small and conical or sub-pedicilated, as it is in *I. ovatus.* It clearly belongs to that group of Illæni for which Mr. Conrad proposed the generic name *Thaleops.*

Locality and formation.—Mingan Islands, Black River limestone ; appears to be abundant there in a fragmentary condition.

Collector.—J. Richardson.

ILLÆNUS CLAVIFRONS. (N.S.)

[Perhaps a variety of *I. conifrons.*]

Description.—This species has much the form of *I. conifrons*, but differs from it in having the unexpanded part of the glabella one-fourth shorter and the expanded front portion depressed convex instead of conical. The entire surface is coarsely punctured, the punctures being smaller on the front part of the head than they are on the posterior half.

Locality and formation.—Mingan Islands, in both the Chazy and Black River limestones.

Collectors.—Sir W. E. Logan. J. Richardson.

ILLÆNUS ARCTURUS. (Hall.)

ILLÆNUS ARCTURUS. Hall. *Palæontology of N.Y.*, vol. I., p. 23, plate 4, bis. Fig. 12.

Specimens of detached glabellæ agreeing very nearly with Professor Hall's figures occur in the Chazy and Black River limestones at the Mingan Islands. One of the fragments indicates an individual three or four inches in length.

ILLÆNUS ORBICAUDA. (N.S.)

Description.—The pygidium is sub-orbicular or including the anterior lateral angles, a broad semi-oval, the length one inch, and the greatest width thirteen and a half lines. The front margin is tri-lobed, the middle lobe being convex, and nearly two-thirds the whole width. The side lobes incline backwards at an angle of about 80° with the longitudinal axis; the fulcral angle is at about

one line from the dorsal furrow, or one-third the length of the side-lobe. Outside of the fulcral angle the corner of the pygidium is strongly folded down or bevelled as it were to permit of the pleuræ sliding over it in the act of rolling up. The dorsal furrow is broad and shallow and its direction is remarkable; at about half a line from the anterior margin it curves outwards, so that in a distance of five lines the middle of the furrow has approached to within one line of the lateral margin, at which distance it continues all round; the furrow is wide, shallow, broadly concave, and not so distinct at the posterior margin as it is in the anterior half. In consequence of this peculiar course of the dorsal furrow, the axis or central lobe instead of being conical and small as it is in other species is sub-orbicular and occupies nearly the whole superficies of the pygidium. In this respect this species differs widely from any of those above described. The pygidium is rather strongly and evenly convex, and the surface is smooth. The width of the middle lobe of the anterior margin appears to shew that the axis of the thorax is nearly equal to two-thirds the whole width.

Locality and formation.—Gemache Bay, Anticosti, base of the Middle Silurian.

Illænus grandis. (n.s.)

Description.—Very large, the fragments indicating individuals eight or nine inches in length. The pygidium transversely sub-oval, strongly trilobed in front, the anterior lateral angles largely truncated, and the outline of the posterior two-thirds very nearly a semicircle or rather a depressed cone. The central lobe of the front margin of the pygidium is convex and nearly half the whole width, being in the proportion of 11 to 26. The margin on each side of the central lobe is straight, and nearly at a right angle with the longitudinal axis until it approaches the fulcrum when it makes a short curve and turns back so as to make the fulcral angle about 45.° The distance of the fulcral angle from the dorsal furrow is about half the width of the middle lobe; the length of the side caused by the truncation of the anterior angles rather more than half. The anterior third of the pygidium is flattened or depressed convex, but the margin all round is suddenly curved down. The surface is smooth.

A pygidium 25 lines wide is 18 lines in length. Only a fragment of the thorax of this specimen is preserved, consisting of

seven of the pleuræ and the impressions of eight of the segments of the axis, and according to such evidence as can be gleaned from the measurement of these, the thorax nust be thirteen lines in length and the axis eleven lines wide at the last segment.

One of the specimens is a pygidium $3\frac{3}{4}$ inches wide, and must have belonged to an individual over eight inches in length.

This species closely resembles *I. Davisii*, Salter (British Fossils, Decade 2, Pl. 2.) but in that species the anterior margin of the pygidum is straighter, the lateral angles not so decidedly truncated, the pleuræ more abruptly bent, and the fold under the posterior margin broader. From these differences in the pygidium, it may be inferred that the head when discovered wlll exhibit other grounds for specific distinction.

Locality and formation.—Anticosti, Hudson River Group, and Middle Silurian.

AMPHION CANADENSIS. (N.S.)

a *b*

FIG. 12.

a Glabella. *b* Pygidium.

Description.—The glabella in the only fragment of the head that I have seen is sub-quadrate, a little more than two lines in length and the same in width, a little narrower behind than in front, the sides straight or gently concave, the front margin convex, and the posterior margin concave. It is divided into four lobes by three pairs of furrows. The posterior furrow extends entirely across and is arched forward in the middle to correspond with the concavity of the posterior margin. The other four furrows extend rather more than one-third across. The two posterior lobes occupy a little less than half the whole length. The front margin of the anterior lobe has a short furrow in the middle and an oblique one on each side half-way between the middle and the anterior angles. The glabella is moderately convex, and the sides are separated from the cheeks by deep narrow furrows.

Pygidium with six segments in the conical axis and ten ribs in the side lobes, five on each side. The anterior pairs of ribs at first project outwards for about one-third their length or a little less, when they make a short curve and become nearly parallel

with the longitudinal axis of the body. The direction of the next pair is the same only that the curve is nearer the axis. The other three pairs are nearly parallel throughout.

The length of the axis of the pygidium is a little greater than the length of the central or terminal pair of ribs, and its last segment is triangular. The ribs are all pointed at their extremities and appear to project a little beyond the true margin of the pygidium.

In addition to the small specimens above figured, we have several other imperfect tails about three-fourths of an inch in length each. In these the ribs are more cylindrical and distinctly separated, and more curved outwards than they are in the small specimens. The axis is convex and obtusely angular along the middle. These differences I think may be the changes induced by the growth of the individuals. The species probably attained the length of one or two inches.

Differs from the Russian species *A. Fischeri* (Eichwald) in having the extremities of the ribs of the pygidium pointed instead of obtuse, and from *A. Lindaueri* (Barrande) in having them more nearly parallel.

It is an interesting fact that associated with this trilobite, the only species of the genus yet found in the Canadas, we find a group of *Cystideæ*, allied to the European *Echinosphærites*, and also a *Bolboporite* closely allied to the *B. mitralis*, which occurs along with *A. Fischeri* in the Lower Silurian rocks of Russia. Our coral has a smooth hemispherical solid base, and a small conical celluliferous upper extremity, often slender and pointed and half the whole length. It appears to me to be a distinct species, and it might be called *B. Americana.*

Locality and formation.—*A. Canadensis* ocurs in the Chazy Limestone at the Mingan Islands, and also in the same formation near Montreal. In both localities it is associated with *B. Americana.*

Collector.—Sir W. E. Logan.

Triarthrus glaber. (n.s.)

Description.—This species closely resembles *T. Beckii*, but has not the row of short spines along the middle of the axis. In specimens that are crushed quite flat, the form is elongate oval, and obtuse at both ends. The length is about twice the width, the central lobe as wide as the side lobes, or very nearly so. In

the body and pygidium there are altogether nineteen segments, of which it is probable fourteen or fifteen belong to the tail, the precise number not determined. The front margin of the head is very obtuse, being in some specimens straight for more than half the width and in others even a little emarginate in the middle. The tail is either broadly rounded, or slightly emarginate at the extremity. I think that when perfect and not at all flattened by pressure, this species must be rather convex and its width a good deal less than half the length. From the size of several of the fragments, large individuals are probably three inches long, but the more common length is from one to two inches.

Locality and formation.—Lake St. Johns, Utica Slate.

Collector.—T. Richardson.

The three species of *Iriarthrus* known in Canada may be thus distinguished:—

1. Triarthrus Beckii. (Green.)

A row of short spines along the middle of the axis of the thorax.

2. Triarthrus spinosus. (Billings.)

A long slender spine from the middle of the neck segment of the glabella, a similar spine from the eighth segment of the axis of the thorax, and two others from the posterior angles of the head, one on each side probably attached to the cheek pieces.

3. Triarthrus glaber. (Billings.)

With no spines either on the thorax or the head.

ART. XXIX.—*On the Aurora Borealis of the 28th of August 1859, By* Charles Smallwood, M.D., LL.D., *Professor of Meteorology in the University of McGill College, Montreal.*

It is not the intention of the present short notice to endeavour, however faintly, to record the splendid display of the Aurora Borealis of the night of the 28th of August 1859,—to describe its more than earthly grandeur, would far surpass all human efforts; even to pencil its varied beauties, its gorgeous and ever changing tints, its crimson curtains of unusual splendour, suspended as it were from the vast celestial vault, would far excel the powers of human art: our object is to place on record some of the Physical signs by which it was accompanied.

At 8·30 p.m., there was no appearance of Aurora noticed here, the sky was then cloudy, covered by *Cumulus et Cumulo Stratus* clouds to the extent of 8.10th.

At 9 p.m,, which is one of the usual hours for observation at this place, the appearances were thus recorded: "Splendid Aurora Borealis extending nearly over the whole horizon with the exception of a small space in the S. & S. W., sky covered over with patches and streamers of Auroral light,—varying in colour from a pale yellow to deep orange and violet or crimson, giving the appearance of moon-light and nearly as light and bright as when the moon is at its full and giving rise to nearly the same colour." The horizontal and vertical movements were frequent and very rapid and it seemed as though the *Cumulus* and *Cumulo stratus* clouds were lighted up with the Aurora. The *exact moment* of its appearance here was not observed, but it was between 8·30 and 9 p.m., this appearance lasted, with modifications, till nearly sunrise.

There was also a fine display on the following night (Monday) the 29th, but nothing to be compared in brilliancy to the Aurora of the previous evening. The sky was on this occasion cloudless, a few streamers were occasionally seen tinted with a pale violet colour.

The 26th day was mild and pleasant, mean Temperature 69°4, at 8 p.m., distant lightning was observed in the E., but its presence did not affect the Electometers. Volta's Electrometer No. 1 indicated scarcely 2 degrees, positive.

The 27th day was partly clouded. Mean Temperature 64°7, shewing a decrease in Temperature, and a falling Barometer.

The 28th day (Sunday) was for the most part cloudy, the following is an extract from the register,

Day.	Hour.	Barometer.	Temperature.	Tension of Vapour.	Thermometer.	Direction of Wind.	Miles Linear.	Solar radiation.	Terrestrial radiation.	CLOUDS.
28	6 a. m.	29.737	50.7	.290	.82	W.N.W	93.40			Cum. Str. 6.
	2 p. m.	689	59.2	.242	.48	W.N.W	40.70	91°4	34°8	" 4.
	10 p. m.	753	51.7	.302	.82	W.N.W	84.10			" 10 Spl'd A.B.
29	6 a. m.	700	50.6	.301	.71	W	251.30			Str. 2.
	2 p. m.	714	66.4	.631	.66	W	51.30	90°8	37°5	Clear.
	10 p. m.	791	50.1	.258	.71	W	164.10			Clear Aurora Borealis.
30	6 a. m.	730	41.4	.169	.65	W.S.W.	9.60			Clear Frost.
	2 p. m.	701	59.7	.235	.46	W.S.W.	14.40	85°2	25°2	Cum. Str. 6.
	10 p. m.	670	56.0	.385	.84	W.S.W.	6.60			Nim. 10 R'n at 4.45 p.m.

The most remarkable incident, and to which it is more particularly necessary to advert, was the unusual and great amount of Atmospheric Electricity manifested as being present. At 9 p.m. the Electrometers indicated a maximum of 250 degrees in terms of Volta's Electrometer No. 1, of a positive character (but almost constantly varying in intensity) an amount equalled only during the Thunder storms of summer and the heavy Snow storms of winter. The amount during the following day and night indicated a maximum of 10 degrees which is however somewhat above the usual average.

The appearances would lead to the opinion that the *Cumulus* and *Cumulo stratus* clouds which generally do not occupy any great altitude might have been the medium of conducting the Atmospheric Etectricity to the earth, for the indications of the Electrometers were such as is present during the passage of clouds charged with electricity, and this phenomenon seems to have extended to the wires of the Electro-Magnetic Telegraph.

The following day and night indicated a small increase on the usual amount of Electricity, this may be owing to the continued presence of the Aurora, or in some measure may be owing to the decrease in temperature, accompanied by high wind and a great amount of Terrestrial Radiation. The Radiator indicated 25·2 degrees, and frost, which was destructive to vegetables, occurred on the morning of the 30th. The sky was cloudless on the 29th, but rain set in at 4·45 p.m. of the 30th, clouds began to form before noon of this day.

Similar indications of the Electrical state of the Atmosphere during the Aurora Borealis were never observed here, although its effect on the Magnetic Telegraph has been before witnessed, and reference is made to the same effects during the Aurora of the 19th Feby. 1852, which was also visible at this place. It is thus recorded: "From 6·30 to 7 p.m., a curtain or veil of Auroral light completely round the horizon terminating in a point in the Zenith near B *auriga*, of a crimson, green and yellow colour, the sky was cloudless and stars were distinctly visible through it." On the same night there was an immense eruption of Mauna Loa, the great volcano on Hawaii in the Sandwich Islands, a slight shock of an earthquake wae felt here at 5·40 a.m., on the morning of the 11th day (Feby 1852) the wave passing from the W. N. W.

The only display presenting such appearances as that of August

last, was seen here in December 1836, and that display was accompanied by a cloudy state of the sky, the Auroral light was then of a deep violet (or blood colour) which gave rise to the popular belief that it predicted the unfortunate outbreak of 1837.

I did not then possess the means of ascertaining the Electrical state of the Atmosphere; and the only Electric Telegraph then in existence I believe on this Continent was in the laboratory of Professor Henry of Princetown N. J., now the respected Secretary of the Smithsonian Institution at Washington, so that the precise effects at that period could not be observed.

In reference to the Aurora Borealis of the beginning of September (which may have been probably a continuation of the same meteor as the 28th of August,) it was visible here on the night of the 2nd day, the 1st and 3rd being cloudy and rainy. The captain of the Barque James W. Paige, at N. York, reports that " from 8 P.M. to 3 A.M. of the 3rd of September the whole horizon was as light as any sunshiny day, the peculiarity of it was that the sky was completely overcast with very black clouds and at times it rained in torrents," but none of these appearances were seen here on the night of the 3rd Sept.

The Aurora Borealis of the 28th of August was seen generally in Europe, in London England, it was first seen at 10·30 p.m., but in more southern Latitudes it made its appearance soon after sunset; it was followed by Earthquakes in England and in Italy.

Mr. E. J. Lowe of the Beetson Observatory first observed it at 8·40 p.m., and his description in reference to appearances and the cloudy state of the sky, coincides with the appearances observed here; and Mr. Burder of Clifton, England, calls attention to some remarkable appearance of Solar Spots. Reports of its appearance in Havanna and many other places on the American Continent South of us, have been received.

Professor Henry of the Smithsonian Institution is investigating phenomena in reference thereto, and which may be looked forward to with great expectations, possessing, as he does, such ample means of collecting facts, and a perfect knowledge of the present state of Electrical Science.

It is much to be desired that the facts about to be collected should establish the origin or source of this Meteor. There are certain points which bear strongly upon the opinion of its electrical origin. Its connection during these extraordinary displays, with Earthquakes and Volcanic Eruptions seems to be almost an established fact.

The appearance of spots on the sun's disc is also another interesting feature in this enquiry, in connection with the Magnetism of the Earth.

At an early period of Electrical investigations, Priestley enquired, "if the empty space above the clouds might not always be filled with Electricity ? and he asks may not Thunders, Earthquakes be owing to the re-establishment of an equilibrium ?"

It remains for modern investigations to answer these important questions.

St. Martin, Isle Jésus,
1st October, 1859.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, ABERDEEN, SEPTEMBER 14, 1859.*

A large and pleasant Meeting of the Members of the British Association began on Wednesday, at Aberdeen, under the immediate auspices of the Prince Consort, whose speech occupied the evening, and whose presence was rendered still more gracious by an invitation of the Members to an excursion and lunch at Balmoral during the week. The old Scottish loyalty broke out in the counties adjoining Aberdeenshire and Kincardineshire. Two thousand tickets were speedily sold, and by Tuesday morning every available nook in the Music Hall being filled, the sale of Associate tickets had to be stopped. Here was a flush of prosperity! The local arrangements were admirable—reviving dreams of that old Scottish hospitality so amusingly celebrated by Ben Johnson and Taylor, the Water Poet. The Clubs and News-Rooms were generally thrown open to the scientific visitors. Non-resident Members of the Association got admission to the Northern Club, and the Union Club, Market Street, without the forms of introduction. The Committees of the Athenæum News Rooms and of the News Rooms, Corn Exchange, opened their rooms to all Members of the Association on producing their tickets. A crowd of Exhibitions also were open to Members on producing their tickets:—such as the Exhibition of Historical Portraits and Objects of Antiquity, in the Music Hall Building,—the Photographic Exhibition, in the Music Hall Buildings,—Collections illustrating the Geology of the North of Scotland, in the Museum

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* Cited from the Athenæum.

of Marischal College,—and the Horticultural Exhibition, King's College. Marischal College, Free Church College, Advocates' Hall, Medico-Chirurgical Society's Library and Hall, and the various prisons, reformatories, and asylums were likewise opened,—as were also most of the great manufactories. The company from a distance was large and brilliant; the papers promised were of scientific importance. Nothing was wanting to make the Meeting at Aberdeen pleasant and memorable.

Before the opening of the doors of the Music Hall the number of tickets issued to the public amounted to more than 2,500.

GENERAL COMMITTEE.

The General Committee held their first meeting in the Library of Marischal College. Professor Owen stated that the number of Associates already admitted amounted to 2,000; and the total number of Members and Associates altogether was nearly as much as the Music Hall could accommodate. He therefore proposed that the Committee should limit the admission of Associates. There was no limit to the admission of Members. The proposal was adopted, as we have already said.

The minutes of the last two Meetings were read and approved of—detailing the proceedings of the Committee as to the choice of Aberdeen for the present Meeting.

Professor Phillips read the Report of the Council, which chiefly pertained to proposals for more extended meteorological and magnetical observations and to the work of the Kew Observatory for the past year.

GENERAL MEETING.

The General Meeting was held, in the evening, at the Music Hall.—Prof. Owen on rising to hand over his Presidency to H. R. H. the Prince Consort, said:—Gentlemen of the British Association,—In rising to perform the brief concluding duty of my office, I may congratulate you on the present sound condition of the Association, and am happy to say that I leave its affairs in a more prosperous state than I found them. Yet this prosperity has for some years been progressive, more especially as regards the direct scientific aims of the Association. It was exemplified last year, by the presence of almost every surviving Founder, with large additions of working scientific Members, at our Meeting at Leeds; it is clearly manifested by the present distinguished assemblage, including many of our most eminent Continental and

American fellow-labourers in science, whom the distance of our present place of meeting has not daunted in their desire to co-operate with us. This prosperous career of the Association, I believe, is, in some measure, due to the element of common sense which mingles with our purely scientific aims. The Founders and Executive of the Association have sought to harmonize its general course of action with the spirit of the social feelings and arrangements and constitution of Great Britain. Accordingly, it has been the custom of the British Association for the Promotion of Science to select, in connexion with its highest office, the names, alternately, of those who are habitually occupied in scientific labours, and of those who combine such pursuits, or an active interest in science, with high social rank and its attendant influence and duties. With pleasure we recall to mind, in the latter category of Presidents, the Earl of Harrowby, the Marquis of Northampton, the Duke of Argyll; and now, our election of this day is ratified by the presence of the highest personage nearest the Sovereign of these realms. We derive from the consent of H. R. H. the Prince Consort to charge himself with the duties of the office the best assurance that the constitution and Acts of our Association have met with the Royal approbation. I need not before this assembly, representing as it does those classes who have always best appreciated it, dwell on the benign influence His Royal Highness's co-operative labours, addresses and example on every movement and organization tending to advance the moral and intellectual condition of the people of Great Britain. Gentlemen, I thank you most respectfully and sincerely for the confidence you have reposed in me during the past year, and, with a grateful sense of the many advantages which I have derived therefrom, permit me to say, that not among the least do I regard my present honourable relation in having, as my final duty, to resign my office and present chair to H. R. H. the Prince Consort.

The Royal President then rose and said:—

The President's Address.

Gentlemen of the British Association,—Your kind invitation to me to undertake the office of your President for the ensuing year could not but startle me on its first announcement. The high position which science occupies, the vast number of distinguished men who labour in her sacred cause, and whose achievements, while spreading innumerable benefits, justly attract the admiration of mankind, contrasted strongly in my mind with the conscious-

ness of my own insignificance in this respect. I, a simple admirer and would-be student of science, to take the place of the chief and spokesman of the scientific men of the day, assembled in furtherance of their important objects!—the thing appeared to me impossible. Yet, on reflection, I came to the conclusion that, if not as a contributor to, or director of your labours, I might still be useful to you, useful to Science, by accepting your offer. Remembering that this Association is a popular Association, not a secret confraternity of men jealously guarding the mysteries of their profession, but inviting the uninitiated, the public at large, to join them, having as one of its objects to break down those imaginary and hurtful barriers which exist between men of science and so-called men of practice—I felt that I could, from the peculiar position Providence has placed me in this country, appear as the representative of that large public, which profits by and admires your exertions, but is unable actively to join in them; that my election was an act of humility on your part, which to reject would have looked like false humility, that is, like pride, on mine. But I reflected further, and saw in mine acceptance the means, of which necessarily so few are offered to Her Majesty, of testifying to you, through the instrumentality of her husband, that your labours are not unappreciated by your Sovereign, and that she wishes her people to know this as well as yourselves. Guided by these reflections, my choice was speedily made, for the path of duty lay straight before me.

If these, however, are the motives which have induced me to accept your flattering offer of the Presidency, a request on my part is hardly necessary that you will receive my efforts to fulfil its duties with kind indulgence.

If it were possible for anything to make me still more aware how much I stand in need of this indulgence, it is the recollection of the person whom I have succeeded as your President—a man of whom this country is justly proud, and whose name stands among the foremost of the Naturalists in Europe for his patience in investigation, conscientiousness in observation, boldness of imagination, and acuteness in reasoning. You have, no doubt, listened with pleasure to his parting address, and I beg to thank him for the flattering manner in which he has alluded to me in it.

LOCAL FEATURES.

The Association meets for the first time to-day in these regions and in this ancient and interesting city. The Poet, in his works

of fiction, has to choose, and anxiously to weigh, where to lay his scene, knowing that, like the Painter, he is thus laying in the background of his picture, which will give tone and colour to the whole. The stern and dry reality of life is governed by the same laws, and we are here living, feeling, and thinking under the influence of the local impressions of this northern seaport. The choice appears to be a good one. The travelling philosophers have had to come far, but in approaching the Highlands of Scotland they meet Nature in its wild and primitive form, and Nature is the object of their studies. The geologist will not find many novelties in yonder mountains, because he will stand there on the bare backbone of the globe, but the primary rocks, which stand out in their nakedness, exhibit the grandeur and beauty of their peculiar form, and in the splendid quarries of this neighbourhood are seen to peculiar advantage the closeness and hardness of their mass, and their inexhaustible supply for the use of man, made available by the application of new mechanical powers. On this primitve soil the botanist and zoologist will be attracted only by a limited range of plants and animals, but they are the very species which the extension of agriculture and increase of population are gradually driving out of many parts of the country. On those blue hills the red deer, in vast herds, holds undisturbed dominion over the wide heathery forest, until the sportsman, fatigued and unstrung by the busy life of the bustling town, invades the moor, to regain health and vigor by measuring his strength with that of the antlered monarch of the hill. But, notwithstanding all his efforts to overcome an antagonist possessed of such superiority of power, swiftness, caution, and keenness of all the senses, the sportsman would find himself baffled, had not Science supplied him with the telescope and those terrible weapons which seem daily to progress in the precision with which they carry the deadly bullet, mocking distance, to the mark.

In return for the help which Science has afforded him, the sportsman can supply the naturalist with many facts which he alone has opportunity of observing, and which may assist the solution of some interesting problems suggested by the life of the deer. Man, also, the highest object of our study, is found in vigorous, healthy development, presenting a happy mixture of the Celt, Goth, Saxon, and Dane, acquiring his strength on the hills and the sea. The Aberdeen whaler braves the icy regions of the Polar Sea, to seek and to battle with the great monster of the

deep; he has materially assisted in opening these ice-bound regions to the researches of Science; he fearlessly aided in the search after Sir John Franklin and his gallant companions, whom their country sent forth on this mission; but to whom Providence, alas! has denied the reward of their labours, the return to their homes, to the affectionate embrace of their families and friends, and the acknowledgment of a grateful nation. The city of Aberdeen itself is rich in interest for the philosopher. Its two lately-united Universities make it a seat of learning and Science. The collection of antiquities, formed for the present occasion, enables him to dive into olden times, and by contact with the remains of the handiwork of the ancient inhabitants of Scotland, to enter into the spirit of that peculiar and interesting people, which has always attracted the attention and touched the hearts of men accessible to the influence of heroic poetry. The Spalding Club, founded in this city, for the preservation of the historical and literary remains of the north-eastern counties of Scotland, is honourably known by its important publications.

ORIGIN AND OBJECTS OF THE ASSOCIATION.

Gentlemen, this is the twenty-ninth anniversary of the foundation of this Association; and well may we look back with satisfaction to its operations and achievements throughout the time of its existence. When, on the 27th of September, 1831, the Meeting of the Yorkshire Philosophical Society took place at York, in the theatre of the Yorkshire Museum, under the presidency of the late Earl of Fitzwilliam, then Viscount Milton, and the Rev. W. Vernon Harcourt eloquently set forth the plan for the formation of a British Association for the Promotion of Science, which he showed to have become a want for his country, the most ardent supporter of this resolution could not have anticipated that it would start into life full grown, as it were; enter at once upon its career of usefulness, and pursue it without deviation from the original design, triumphing over the oppositions which it had to encounter, in common with everything that is new and claims to be useful. Gentlemen, this proved that the want was a real, and not an imaginary one, and that the mode in which it was intended to supply that want was based upon a just appreciation of unalterable truths. Mr. Vernon Harcourt summed up the desiderata in graphic words, which have almost identically been retained as the exposition of the objects of the Society, printed at the head of the annually-appearing volume of its *Transactions*:—"To give a

stronger impulse and more systematic direction to scientific enquiry,—to promote the intercourse of those who cultivate Science in different parts of the empire, with one another and with foreign philosophers,—and to obtain a more general attention to the objects of Science, and a removal of any disadvantages of a pnblic kind which impede its progress."

ORJECT AND DUTY OF SCIENCE.

To *arrange* and *classify* that universe of knowledge becomes therefore the first, and perhaps the most important, object and duty of Science. It is only when brought into a system, by separating the incongruous and combining those elements in which we have been enabled to discover the internal connexion which the Almighty has implanted in them, that we can hope to grapple with the boundlessness of His creation, and with the laws which govern both mind and matter.

The operation of Science then has been, systematically to divide human knowledge, and raise, as it were, the separate groups of subjects for scientific consideration, into different and distinct sciences. The tendency to create new sciences is peculiarly apparent in our present age, and is perhaps inseperable from so rapid a progress as we have seen in our days; for the acquaintance with and mastering of distinct branches of knowledge enables the eye, from the newly gained points of sight, to see the new ramifications into which they divide themselves in strict consecutiveness and with logical necessity. But in thus gaining new centres of light, from which to direct our researches, and new and powerful means of adding to its ever-increasing treasures, Science approaches no nearer to the limits of its range, although travelling further and further from its original point of departure. For God's world is infinite; and the boundlessness of the universe, whose confines appear ever to retreat before our finite minds, strikes us no less with awe when, prying into the starry crowd of heaven, we find new worlds revealed to us by every increase in the power of the telescope, than when the microscope discloses to us in a drop of water or an atom of dust, new worlds of life and animation, or the remains of such as have passed away.

From amongst the political sciences it has been attempted in modern times to detach one which admits of being severed from individual political opinions, and of being reduced to abstract laws derived from well authenticated facts. I mean Political Economy,

based on general statistics. A new Association has recently been formed, imitating our perambulating habits, and striving to comprehend in its investigations and discussions even a still more extended range of subjects, in what is called "Social Science." These efforts deserve our warmest approbation and good will. May they succeed in obtaining a purely and strictly scientific character! Our own Association has, since its Meeting at Dublin, recognized the growing claims of Political Economy to scientific brotherhood, and admitted it into its Statistical Section. It could not have done so under abler guidance and happier auspices than the Presidency of the Archbishop of Dublin, Dr. Whately, whose efforts in this direction are so universally appreciated. But even in this Section, and whilst Statistics alone were treated in it, the Association as far back as 1833, made it a rule that, in order to ensure positive results, only those classes of facts should be admitted which were capable of being expressed by numbers, and which promised, when sufficiently multiplied, to indicate general laws.

If, then, the main object of Science—and I beg to be understood henceforth, as speaking only of that Section which the Association has under its special care, viz., Inductive Science—if, I say, the object of Science is the discovery of the laws which govern natural phenomena, the primary condition for its success is—accurate observation and collection of facts in such comprehensiveness and completeness as to furnish the philosopher with the necessary material from which to draw safe conclusions.

SCIENTIFIC MEMOIRS AND REPORTS.

One of the latest undertakings of the Association has been, in conjunction with the Royal Society, to attempt the compilation of a classified catalogue of Scientific Memoirs, which, by combining under one head the titles of all memoirs written on a certain subject, will, when completed, enable the student who wishes to gain information on that subject to do so with the greatest ease. It gives him, as it were, the plan of the house, and the key to the different apartments in which the treasures relating to his subject are stored, saving him at once a painful and laborious search, and affording him at the same time an assurance that what is here offered contains the whole of the treasures yet acquired.

While this has been one of its latest attempts, the Association has from its very beginning kept in view that its main sphere of usefulness lay in that concentrated attention to all scientific operations which a general gives to the movements of his army,

watching and regulating the progress of his impetuous soldiers in the different directions to which their ardour may have led them, carefully noting the gaps which may arise from their independent and eccentric action, and attentively observing what impediments may have stopped, or may threaten to stop, the progress of certain columns.

Thus it attempts to fix and record the position and progress of the different labours by its Reports on the state of Sciences published annually in its *Transactions;*—thus it directs the attention of the labourers to those gaps which require to be filled up, if the progress is to be a safe and steady one;—thus it comes forward with a helping hand in striving to remove those impediments which the unaided efforts of the individual labourer have been or may be unable to overcome.

Let us follow the activity of the Association in these three different directions.

The Reports on the state of Science originate in the conviction of the necessity for fixing, at given intervals, with accuracy and completeness, the position at which it has arrived. For this object the General Committee of the Association entrusts to distinguished individuals in the different branches of Science the charge of becoming, as it were, the biographers of the period. There are special points in different Sciences in which it sometimes appears desirable to the different Sections to have special Reports elaborated; in such cases the General Committee, in this capacity of the representative assembly of all the Sciences, reserves to itself the right of judging what may be of sufficient importance to be thus recorded.

The special subjects which the Association points out for investigation, in order to supply the gaps which it may have observed, are—either such as the philosopher alone can successfully investigate, because they require the close attention of a practised observer, and a thorough knowledge of the particular subject; or they are such as require the greatest possible number of facts to be obtained. Here Science often stands in need of the assistance of the general public, and gratefully accepts any contributions offered, provided the facts be accurately observed. In either case the Association points out *what* is to be observed, and *how* it is to be observed.

The first is the result of the same careful sifting process which the Association employs in directing the issue of special Reports. The investigations are entrusted to specially-appointed committees,

or selected individuals. They are in most cases not unattended with considerable expense, and the Association, not content with merely suggesting and directing, furnishes by special grants the pecuniary means for defraying the outlay caused by the nature and extent of the enquiry. If we consider that the income of the Association is solely derived from the contributions of its members, the fact that no less a sum than £17,000 has, since its commencement, been thus granted for scientific purposes, is certainly most gratifying.

The question *how* to observe, resolves itself into two—that of the scientific method which is to be employed in approaching a problem or in making an observation, and that of the philosophical instruments used in the observation or experiment. The Association brings to bear the combined knowledge and experience of the scientific men, not only of this but of other countries, on the discovery of that method which, while it economizes time and labour, promises the most accurate results. The method to which, after careful examination, the palm has been awarded, is then placed at the free disposal and use of all scientific investigators. The Association also issued, where practicable, printed forms, merely requiring the different heads to be filled up, which, by their uniformity, become an important means for assisting the subsequent reduction of the observations for the abstraction of the laws which they may indicate.

At the same time most searching tests and inquiries are constantly carried on in the Observatory at Kew, given to the Association by Her Majesty, the object of which is practically to test the relative value of different methods and instruments, and to guide the constantly progressive improvements in the construction of the latter.

The establishment at Kew has undertaken the further important service of verifying and correcting to a fixed standard the instruments of any maker, to enable observations made with them to be reduced to the same numerical expression. I need hardly remind the inhabitants of Aberdeen that the Association, in one of the first years of its existence, undertook the comparative measurement of the Aberdeen standard scale with that of Greenwich,—a research ably carried out by the late Mr. Baily.

We may be justified in hoping, however, that by the gradual diffusion of Science, and its increasing recognition as a principal part of our national education, the public in general, no less than

the Legislature aud the State, will more and more recognize the claims of Science to their attention ; so that it may no longer require the begging box, but speak to the State, like a favoured child to its parent, sure of his parental solicitude for its welfare ; that the State will recognize in Science one of its elements of strength and prosperity, to foster which the clearest dictates of self-interest demand.

HUMBOLDT.

If the activity of this Association, such as I have endeavoured to describe it, ever found or could find its personification in one individual—its incarnation, as it were,—this had been found in that distinguished and revered philosopher who has been removed from amongst us in his ninetieth year, within these last few months. Alexander von Humboldt incessantly strove after dominion over that universality of human knowledge which stands in need of thoughtful government and direction to preserve its integrity ; he strove to tie up the *fasces* of scientific knowledge to give them strength in units. He treated all scientific men as members of one family, enthusiastically directing, fostering, and encouraging enquiry, where he saw either the want of, or the willingness for it. His protection of the young and ardent student, led many to success in their pursuit. His personal influence with the Courts and Governments of most countries in Europe enabled him to plead the cause of Science in a manner which made it more difficult for them to refuse than to grant what he requested. All lovers of science deeply mourn for the loss of such a man. Gentlemen, it is a singular coincidence, that this very day on which we are here assembled, and are thus giving expression to our admiration of him, should be the anniversary of his birth.

ADVANTAGES OF THE ASSOCIATION.

To return to ourselves, however : one part of the functions of the Association can receive no personal representation, no incarnation : I mean the very fact of meetings like that which we are at present inaugurating. This is not the thoughtful direction of one mind over acquired knowledge, but the production of new thought by the contact of many minds, as the spark is produced by the friction of flint and steel ; it is not the action of the monarchy of a paternal Government, but the republican activity of the Roman Forum. These Meetings draw forth the philosopher from the hidden recesses of his study, call in the wanderer over

the field of science to meet his brethren, to lay before them the result of his labours, to set forth the deductions at which he has arrived, to ask their examination, to maintain in the combat of debate the truth of his positions and the accuracy of his observations. These Meetings, unlike those of any other Society, throw open the arena to the cultivators of all sciences, to their mutual advantage: the Geologist learns from the Chemist that there are problems for which he had no clue, but which that science can solve for him; the Geographer receives light from the Naturalist, the Astronomer from the Physicist and Engineer, and so on. And all find a field upon which to meet the public at large, invite them to listen to their Reports, and even to take part in their discussions,—show to them that Philosophers are not vain theorists, but essentially men of practice,—not conceited pedants, wrapped up in their own mysterious importance, but humble inquirers after truth, proud only of what they may have achieved or won for the general use of man. Neither are they daring and presumptuous unbelievers—a character which ignorance has sometimes affixed to them—who would, like the Titans, storm heaven by placing mountain upon mountain, till hurled down from the height attained by the terrible thunders of outraged Jove; but rather the pious pilgrims to the Holy Land, who toil on in search of the sacred shrine, in search of truth,—God's truth—God's laws as manifested in His works, in His creation.

REVIEWS AND NOTICES OF BOOKS.

Memoirs of the Life of James Wilson, Esq., of Woodville, F.R.S., M. W. S. By the Revd. James Hamilton, D.D., F.L.S. New York: R. Carter & Bros. Montreal: B. Dawson & Son. With portrait, pp. 399.

Mr. Wilson was brother of the celebrated Professor John Wilson of Edinburgh, and although of very unobtrusive character yet was known among a large circle of most attached friends to be a most accomplished scientific and literary gentleman. Having no profession he resided on a small and beautiful property in the parish of Colenton, about two or three miles from Edinburgh. There he cultivated with great assiduity the zoological department of Natural History. Birds, insects, fishes, and the lower forms of

animal life were the objects to which he chiefly devoted his attention. The management and control of the whole Zoological Department of the Encyclopædia Britannica were undertaken by him and most ably executed. His authorship, on this work alone, comprises 900 pages, or equal to *nine* ordinary octavo volumes. He contributed the articles, Angling, Animal Kingdom, Animalculæ, Entomology, Helminthology, Ichthyology, Mammalia Ornithology, Reptiles and Serpents. He also published "Illustrations of Zoology, with historical and descriptive details," folio 1851: "Entomologia Edinensis" 1834; the piscatory part of "The Rod and the Gun" 1840; "Illustrations of Scripture by an animal painter, with notes by a Naturalist" 1842. These besides numerous articles on his favourite studies in Blackwood, the North British Review and other Magazines were the products of his pen. The main features of Mr. Wilson's character were, its meekness of wisdom, warmth of affection, and unostentatious all-comprehending kindness. There was in him a happy harmony of contrasted qualities,—scientific accuracy without pendantry and an unclogged excursive imagination,—fantastic playfulness with strong affection, and steadfast purpose,—freshness of feeling with width of innocent enjoyment, co-existing with great tenderness of conscience and faith unfeigned. He was preëminently a Christian Naturalist. This Memoir is prepared by one of the most genial and happy writers of the present day, and is a beautiful *eloge* of one whose character and labours will long be remembered and admired by the students of Natural History. We cordially commend this book to the Scientific and Christian reader as an interesting and delightful record of a beautiful, vigorous and useful life.

A. F. K.

The Use and Abuse of Tobacco. By John Lizars, M.D., late Professor of Surgery to the Royal College of Surgeons, Edinburgh. Philadelphia: Lindsay & Blakston. Montreal: B. Dawson & Son. Eighth edition, pp. 138.

The object of the author in the publication of this little, but most pregnant book, is, if possible, to correct the progress of Tobacco smoking, and other forms of its use. He finds it difficult to estimate the pernicious consequences produced by habitual smoking, on the number of victims, both old and young. The consumption of Tobacco in Britain alone, in the year 1853,

amounted to the enormous quantity of 29,737,561 pounds or more than a pound to every man, woman and child of the population. When we consider that in every hundred pounds of this drug there is one pound of the most deadly poison known to chemistry, it is obvious that much injury must be done to the human constitution by its so extensive use. The first chapter of this book treats of the general characteristics of tobacco—its history, botany, chemistry and physiological effects; chapter second contains practical observations on its use and abuse; and chapter third communications from distinguished physicians, and extracts from medical writings. There can be no doubt that Dr. Lizars has made out an Indictment, against Tobacco, of the most alarming character. It is the fruitful cause of some of the most painful and horrible diseases to which the human frame is subject. Among others he enumerates ulcerations of the mouth, cancer, dyspepsia, diarrhœa, disease of the liver, congestion of the brain, apoplexy, palsy, mania, loss of memory, nervousness, emasculation, cowardice, &c. The cases and authorities which he adduces in support of his own large experience are numerous and conclusive. Let no one suppose that this is a quack book. It is written by one of the most skilful and judicious of surgeons—one whose reputation is world-wide. We are persuaded that a perusal of this book will convince the most skeptical that tobacco is a most deliterious drug, whether used in the form of smoke, snuff, or *quid*, producing effects on society which neither the public nor the medical profession seem yet to have fairly estimated. In page 103 of this book an experienced surgeon says "that the germs of premature decay which the abuse of tobacco is spreading through the country, will ultimately, in my opinion, prove more overwhelming than even the serious abuse of intoxicating liquors." Another says: "After fifty years of most extensive and varied practice in my profession, I have come to the decision that smoking is the main cause of ruining our young men, pauperizing the working men, and rendering comparatively useless the best efforts of ministers of religion." As a scientific journal we deem it right to warn our youth against the use, in any form whatever, of this disgusting "weed." The Virginian *Nicotiana tabacum*, as well as the Canadian *Nicotiana rustica* should be regarded by every lover of himself and his kind, as a thing to be absolutely proscribed as both destructive to health and morals. We most cordially recommend this little seasonable treatise. A. F. K.

MONTHLY METEOROLOGICAL REGISTER, ST. MARTINS, ISLE JESUS, CANADA EAST, (NINE MILES WEST OF MONTREAL,) FOR THE MONTH OF AUGUST, 1859.

Latitude, 45 degrees 32 minutes North. Longitude, 73 degrees 36 minutes West. Height above the level of the Sea, 118 feet.

BY CHARLES SMALLWOOD, M.D., LL.D.

Day of Month	Barometer, corrected and reduced to 32° F. (English inches.) 6 a. m.	2 p. m.	10 p. m.	Temperature of the Air. F. 6 a. m.	2 p. m.	10 p. m.	Tension of Aqueous Vapour. 6 a. m.	2 p. m.	10 p. m.	Humidity of the Atmosphere. 6 a. m.	2 p. m.	10 p. m.
1	29.719	29.780	29.784	66.1	72.3	69.0	.536	.631	.642	84	81	92
2	866	795	824	68.8	86.2	66.3	518	564	536	79	46	84
3	827	779	752	68.8	90.6	75.1	550	616	686	82	43	83
4	543	481	601	68.9	70.6	70.3	648	688	688	95	92	92
5	656	569	656	69.1	78.6	59.7	606	550	439	88	58	88
6	771	700	791	59.0	70.4	67.2	358	323	463	73	44	77
7	506	535	684	68.4	67.0	58.2	516	310	423	77	48	88
8	775	784	798	60.1	74.7	61.0	403	465	419	79	56	86
9	980	946	30.011	63.2	84.6	66.8	510	590	529	88	51	82
10	900	887	29.892	62.0	90.5	72.3	523	671	631	94	48	81
11	868	748	778	64.9	88.4	71.6	563	650	572	93	47	76
12	728	814	871	70.0	81.4	70.4	665	664	625	92	62	95
13	741	550	720	68.7	86.2	69.0	648	719	599	95	85	85
14	707	680	800	70.0	87.7	69.1	523	623	571	72	48	82
15	817	896	905	63.0	85.1	69.0	510	570	599	88	47	85
16	910	977	920	64.2	82.9	65.9	510	721	509	88	53	81
17	959	916	845	65.0	89.7	65.8	483	637	509	78	47	81
18	861	653	628	60.1	87.6	67.0	456	664	529	88	52	82
19	632	645	763	56.2	72.0	60.5	420	462	338	94	60	65
20	845	851	877	62.0	79.4	60.5	576	465	433	69	47	85
21	882	846	910	64.1	85.0	68.0	464	621	512	77	77	87
22	904	835	899	68.6	84.5	68.2	549	590	612	89	51	90
23	912	844	884	63.8	81.5	67.0	416	545	502	72	47	78
24	806	731	706	60.0	65.5	65.1	606	549	543	88	89	91
25	643	604	689	64.7	77.9	68.4	536	671	577	92	71	85
26	716	650	688	64.2	78.1	66.1	471	588	570	81	62	89
27	614	600	738	63.0	71.1	57.0	485	429	329	86	55	72
28	737	689	753	50.7	59.2	51.7	290	242	302	82	48	82
29	700	714	701	50.6	66.4	50.1	301	331	258	71	63	71
30	750	701	670	41.5	59.7	56.0	169	237	285	65	46	84
31	540	547	586	57.0	59.9	54.0	400	354	355	84	68	89

Day of Month	Direction of Wind. 6 a. m.	2 p. m.	10 p. m.	Mean Velocity in Miles per hour. 6 a. m.	2 p. m.	10 p. m.	Amo'nt of Rain in inches.	Amo'nt of Snow in inches.	Weather, Clouds, Remarks, &c. &c. [A cloudy sky is represented by 10, a cloudless one by 0.] 6 a. m.	2 p. m.	10 p. m.
1	S. E.	S. E.	S.	0.05	4.81	1.30	Inapp.		Cum. Str. 4.	Cu. Str. 10.	Str. 2. Distant Lightning.
2	S. S. W.	S. S. W.	S. S. W.	4.47	1.42	1.98			Clear.	Clear.	Clear.
3	S.	S. E. by E.	S. E. by E.	0.11	0.05	0.01	. . .		"	"	Cu. Str 10.
4	S. E. by S.	W. N. W.	S. S. W.	0.26	5.43	1.11	4.223		Rain.	Cu. Str. 8. Thun-der.	Clear.
5	W. S. W.	W. S. W.	W. S. W.	3.51	6.97	6.28	0.180		Light Cirri 1.	C. C. Str. 9.	Cu. Str. 8.
6	W. N. W.	W. S. W.	S. W.	8.82	9.80	7.35			Clear.	Cirri 4.	" 9.
7	S. W.	W.	W. N. W.	14.42	12.12	12.56	0.070		Cu. Str. 4.	C. C. Str. 8.	" 6.
8	S. W. by W.	S. W. by W.	S.	1.26	0.60	0.83			Clear.	Clear.	Clear.
9	S. W. by S.	S. W. by S.	S.	0.15	1.08	0.01			"	"	"
10	S. S. E.	S. S. W.	S. E.	0.18	0.18	0.00			"	"	"
11	S. E.	S. by E.	S. by E.	0.22	0.97	1.72			"	"	"
12	S. by E.	S. S. W.	S. W.	1.08	1.75	0.73	Inapp.		C. C. Str. 10.	Cu. Str. 10	C. Str. 10. Thunder.
13	W. S. W.	S. S. W.	S. W. by W.	0.36	1.01	3.80	0.186		" 10.	" 4.	Clear.
14	E. by S.	E. S. E.	S. E. by E.	0.20	1.91	0.21			Clear.	Clear.	Cirri 1.
15	N. E. by E	E. by N.	E.	4.00	6.18	5.21			"	"	Clear.
16	N. E. by E	N. E. by E.	N. E. by E.	6.54	4.02	4.05			"	"	"
17	N. E. by E	S. E. by E.	S. E.	0.20	1.65	0.06			"	"	"
18	S. E. by E	S. S. W.	S. W. by W	0.00	0.65	0.80			"	"	"
19	N. N. E.	N. N. E.	N.	2.53	6.36	4.02	0.590		Rain.	Cumuli 1.	Clear. Faint Aurora Borealis.
20	W. S. W.	W.	S. W.	2.15	0.67	0.66			Clear.	Clear.	Clear.
21	W. S. W.	W. S. W.	W. S. W.	1.07	5.33	3.01			"	"	Str. 2. Distant Lightning.
22	N. E.	N. E. by E.	N. E. by E.	2.00	1.50	3.36			C. C. Str. 8.	Cum. Cir. 8.	Clear.
23	N. E. by E	S. E. by E.	S. E.	4.97	5.50	2.41			Clear.	C. C. Str. 6.	Clear. Faint Aurora Borealis.
24	S. E. by E.	S. E. by E.	S. W. by S	2.03	8.78	0.70	1.100		C. C. Str. 8.	Rain	Cu. Str. 4.
25	S. S. W.	S. W.	S. S. W.	0.05	0.02	3.11			Cu. Str. 0.	Cu. Str. 6.	" 4.
26	S. W.	S. W.	W. S. W.	1.32	5.70	2.33			" 10.	Cirr. Str. 4.	Cu. Str. 4. Distant Lightning.
27	W. S. W.	W. by N.	W. N. W.	0.00	6.26	12.80			Clear.	Cirri Cum. 4.	Cu. Str. 6.
28	W. N. W.	W. N. W.	W. N. W.	11.63	5.06	10.51			Cu. Str. 6.	" 4.	Cu. Str. 10. Splendid Aur. Bor.
29	W.	W.	W.	25.11	6.30	20.26			Str. 2. Frost.	Clear.	Clear. Aurora Borealis.
30	W. S. W.	W. S. W.	S. by W.	1.20	1.80	0.82	0.076		Clear.	C. Str. 6.	Rain.
31	S. by W	N. W.	W. by S.	12.13	5.90	0.87	0.231		Cu. Str. 0.	" 4.	Cu. Str. 2.

REPORT FOR THE MONTH OF SEPTEMBER, 1859.

Day of Month	Barometer 6 a. m.	2 p. m.	10 p. m.	Temperature 6 a. m.	2 p. m.	10 p. m.	Tension 6 a. m.	2 p. m.	10 p. m.	Humidity 6 a. m.	2 p. m.	10 p. m.
1	29.660	29.698	29.493	40.8	65.9	55.1	265	519	376	75	47	87
2	547	484	680	50.1	59.6	52.3	535	542	323	93	78	85
3	738	667	623	50.0	57.0	52.9	309	350	361	85	75	93
4	655	713	876	50.4	60.9	51.2	309	325	296	85	61	79
5	857	968	987	50.6	61.0	53.0	328	310	318	89	60	86
6	30.050	30.054	30.115	50.8	58.2	49.1	265	255	297	75	53	85
7	074	000	077	45.7	65.0	54.6	211	296	355	72	44	80
8	072	067	092	47.2	60.4	54.0	291	529	355	89	75	80
9	121	006	001	58.9	70.4	68.2	275	498	371	56	55	85
10	29.922	29.821	29.754	52.9	61.5	61.2	354	498	530	90	91	97
11	546	244	559	61.8	64.6	61.3	500	529	478	97	89	88
12	314	138	167	60.3	74.1	63.3	189	568	453	90	67	80
13	214	262	519	60.8	59.0	46.1	306	289	262	76	57	84
14	267	594	850	50.5	47.8	38.1	180	150	186	77	45	81
15	30.083	30.107	30.154	57.2	50.0	38.1	178	159	165	81	39	72
16	120	044	29.998	34.2	61.3	44.6	114	219	211	75	47	84
17	29.856	29.789	834	42.0	58.2	52.2	228	387	361	87	80	93
18	840	862	818	48.0	75.7	50.1	303	571	290	89	70	82
19	640	629	610	45.2	77.0	61.7	211	534	413	72	59	83
20	632	814	973	55.5	62.4	46.3	405	429	248	94	77	77
21	30.008	943	986	43.0	47.0	48.0	215	294	316	79	89	96
22	29.940	880	887	45.2	51.3	53.6	294	396	397	90	93	95
23	840	844	887	50.0	55.2	52.6	311	383	361	96	90	93
24	834	809	791	50.9	63.2	55.2	348	429	383	92	77	90
25	870	864	869	53.0	62.3	59.6	351	436	462	90	80	90
26	780	840	792	56.0	71.1	61.5	413	544	408	90	73	91
27	761	749	765	57.8	68.2	62.3	436	543	534	90	79	92
28	874	972	30.024	56.7	56.2	50.8	336	357	283	75	78	78
29	30.179	30.169	201	42.7	62.0	43.2	239	311	248	89	56	88
30	179	003	29.961	40.3	70.6	53.2	225	423	318	91	59	56

Day of Month	Wind 6 a. m.	2 p. m.	10 p. m.	Velocity 6 a. m.	2 p. m.	10 p. m.	Rain	Snow	Weather 6 a. m.	2. p. m.	10 p. m.
1	W. S. W.	W. S. W.	S. by E.	5.83	4.46	2.30	. . .		Clear.	Cu. Str. 4.	Rain.
2	W. S. W.	W. N. W.	W. S. W.	14.04	15.13	14.95	0.136		Rain	" 6.	Clear. Aurora Borealis.
3	S. W.	S. by W.	S. E.	5.41	1.96	3.64	0.301		C. C. Str. 4.	Rain.	Rain.
4	W. S. W	W. by S.	W. S. W.	8.01	12.21	10.05	0.800		Cu. Str. 8.	C. C. Str. 6.	Cu. Str. 3.
5	S. W.	W.	W. S. W	3.63	2.08	4.17	Inapp.		C. C. Str. 4.	Cu. Str. 9.	Clear.
6	N. W	N. W.	S. W. by S.	0.61	6.26	4.53			Clear.	C. C. Str. 6.	"
7	S. S. W	W. S. W.	S. W. by W.	0.21	4.00	1.77			C. C. Str. 4.	Cu. Str. 4.	Cir. Cum. 4.
8	W. S. W.	S. S. W.	S. S. W.	0.00	1.31	2.15	. . .		Cirri 4.	Clear.	Clear.
9	S. W.	S. W.	S.	5.07	2.90	1.51			C. C. Str. 4.	"	Clear.
10	S. E.	S. S. E.	S.	0.27	0.51	2.85	0.330		C. Str. 8.	Rain.	Rain.
11	N.	N. E.	S. W.	1.27	8.57	3.98	3.890		Rain, thunder.	"	Clear.
12	S. W	S. W.	S. W	3.30	2.80	7.55			Cu. Str. 9.	C. C. Str. 6.	Cu. Str. 9.
13	W.	W.	W.	10.27	10.16	19.26			" 10.	Cu. Str. 10.	" 4.
14	W.	W. N. W	W.	11.98	10.13	17.01	0.773		Snow, with hail.	" 1	Clear. Aurora Borealis.
15	W. N. W.	W. by N.	S. W.	24.86	14.15	3.70			Clear frost.	Clear.	Cirri 4.
16	S. E.	E. S. E.	E. S. E.	0.01	0.78	0.66			C. C. Str. 8.	"	Clear.
17	E.	E. by N.	N. E. by E.	0.40	1.30	4.38			Cu. Str. 10.	Cu. Str. 10.	Cu. Str. 10.
18	W.	S.	S. by W.	1.92	0.07	0.01			" 10.	Clear.	Clear. Faint Aurora Borealis.
19	E.	S. by E.	S. E. by E.	0.00	0.17	0.15			Clear.	"	Cu. Str. 9.
20	N.	N. E.	E. N. E	3.92	7.61	11.66	0.930		Rain.	Cu. Str. 10.	Clear. Aurora Borealis.
21	E. N. E.	N. E. by E.	N. E. by E	17.87	2.26	17.18	0.771		C. Str. 8.	Rain.	Slight rain.
22	N. E. by E.	N. E. by E.	N. E. by E	15.76	7.65	9.18	1.409		Rain.	"	C. Str. 10.
23	N. E. by E.	N. E. by E.	N. E. by E.	15.17	11.13	4.92	1.970		"	"	" 10.
24	N.	N. E. by E.	N. E. by E.	0.25	0.45	1.26	Inapp.		Cu. Str. 9.	Cu. Str. 6.	Cu. Str. 10.
25	E. S. E.	E. S. E.	S. S. W.	0.36	3.16	0.01			" 10.	" 9.	" 10.
26	S. S. W.	S. W.	S. W.	0.70	0.50	0.09			" 4.	" 4.	" 8.
27	S. S. W.	S. W.	S. W.	0.35	2.43	1.83	Inapp.		C. C. Str. 6.	" 8.	" 10.
28	N. E. by E.	N. N. E.	N. by W.	8.80	6.12	4.04	Inapp.		Cu. Str. 8.	" 9.	" 10.
29	N. E. by E.	E.	E. S. E.	1.95	4.67	0.09	. . . . .		Clear.	Cirr. 2.	Clear. Faint Aurora Borealis.
30	E. by N.	S. E.	S. S. E.	0.57	1.67	2.09			Cu. Str. 4.	Clear.	Clear.

REMARKS FOR AUGUST, 1859.

Barometer { Highest, the 9th day, 30.011 inches. Lowest, " 4th " 29.481 " Monthly Mean, 29.760 inches. Monthly Range, 0.530 "

Thermometer { Highest the 3rd day, 90°9. Lowest, the 30th day, 36°2. Monthly Mean, 68°72. Monthly Range, 54°7.

Greatest intensity of the Sun's rays, 110°8.
Lowest point of terrestrial radiation, 25°2.
Amount of evaporation in inches, 3.17.
Mean of humidity, .742.

Rain fell on 10 days, amounting to 6.666 inches; it was raining 42 hours 55 minutes, and was accompanied by thunder and lightning on 2 days.

Most prevalent wind, the S. W.

Least prevalent wind, N.

Most windy day, the 29th day; mean miles per hour, 17.22.

Least windy day, the 10th day; mean miles per hour, 0.12.

Frost occurred on the 30th day.

Aurora Borealis visible on 4 nights.

The Electrical state of the atmosphere has indicated high intensity.

Ozone was present in rather large quantity.

REMARKS FOR SEPTEMBER, 1859.

Barometer. ... { Highest, the 29th day, 30.201 inches. Lowest, " 12th " 29.138 " Monthly Mean, 29.771 inches. Monthly Range, 1.063 "

Thermometer. { Highest, the 9th day, 78°1. Lowest, " 16th " 29°2. Monthly Mean, 54°31. Monthly Range, 49°2.

Greatest intensity of the Sun's rays, 101°6.
Lowest point of terrestrial radiation, 18°2.
Mean of humidity, 799.
Amount of evaporation in inches, 1.42.

Rain fell on 14 days, amounting to 11.310 inches, it was raining 112 hours 17 minutes, and was accompanied by thunder on 1 day.

Most prevalent wind, N. E. by E.

Least prevalent wind, N.

Most windy day, the 14th day; mean miles per hour, 16.04.

Least windy day, the 19th day; mean miles per hour, 0.10.

Aurora Borealis visible on 5 nights.

The Electrical state of the atmosphere has indicated rather feeble intensity.

Ozone was present in rather large quantity.

THE

CANADIAN

NATURALIST AND GEOLOGIST.

VOL. IV. DECEMBER, 1859. No. 6.

ARTICLE XXX.—*Notes on Egyptian Antiquities presented to the Natural History Society by Hon. Mr. Ferrier.* By a Committee of the Society.

(*Read at Meeting of Oct.* 31*st.*)

1. *Mummy of a Lady, from Thebes.*

This is the body of an aged female, in excellent preservation and in a highly ornamented case. Her name (fac-similed on a reduced scale in Fig. I.) is written opposite the portrait on the bottom of the coffin, and may have been "Abothloé."

The body has been prepared by some process (probably immersion in natron) which has had the effect of destroying the muscles, leaving only the fibrous tissues in a dry and spongy condition. The body has been disembowelled previous to embalming. The surface, especially of the lower extremities, has been smeared with some oily or resinous varnish, and above this has been spread a thick layer of ground spices, apparently applied as a paste, and most copiously on the face and chest, where this material has been moulded in such a manner as to restore, in some degree, the original form of the muscles. The spices are coarsely but uniformly ground, and, under the microscope, present slender stalks and fragments of the shell of globular seeds or berries, smooth or minutely pitted on the surface. The appearance is

somewhat like that of Cassia buds, though not precisely. T· alcohol the spices yield a very small quantity of soluble matter, having a brown colour and heavy resinous and ammoniacal smell; and, after thorough washing in alcohol, the residuum is destitute of odour, and has merely a bitter taste.

Fig 1.

Externally to the spices a square plate of copper-foil had been moulded upon the face; and two smaller pieces had been placed on the upper part of the feet, at the base of the toes.

A quantity of lichen (see Note) had then been placed over the front part of the body to give it a more rounded contour, and to retain the odour of the spices; and it had been swathed in numerous linen cloths, folded over the front, and with many loose pieces put in to fill out the form.

The body lies upon a narrow board, which has previously been used for some other purpose, having a dovetail and pin at one end; but has been rounded on the lower side to fit it for its present use.

The coffin is elaborately ornamented on all sides, and covered with characters and figures of deities. It has also a figure of a lady in full dress, and a male figure lying on a bier; and in another part a similar male figure on the back of the bull Apis. The outer surface has been covered with linen, saturated with white paint or plaster before the figures were drawn upon it. The interior is thickly coated with white paint. The interior sides are inscribed with hieroglyphics, and a female figure, no doubt that of the occupant, is drawn in profile over the middle both of the cover and bottom.

The first finger of the right hand and the little finger of the left hand have been cut off previously to embalming, probably to obtain rings.

The head is finely proportioned, and the features regular; the feet very small and delicate. The measurements are as follows:

Height of body, 5 feet.
Occipital diameter of skull, 7 inches 2 tenths.
Parietal diameter of skull, 5 inches 8 tenths.
Length of foot, 7 inches 5 tenths.

The hair is quite white, straight but short. Its appearance under the microscope is similar to that of ordinary European hair, and its cross section apparently a flat oval.

2. *Mummy of a Man, from Thebes.*

This mummy has no case, and is wrapped in linen closely plied in many folds, and which has apparently been saturated with some resinous substance. The outer fold and bandages have been painted of a dull red colour. The head only was uncovered. It is in good preservation; is not covered with spices; but has been in part covered with bitumen, as if this had been poured upon it or into its cavities, and had in part run over the surface. The eyes have been extracted, and the lids have been carefully moulded so as to project in the natural form. There is abundance of straight brown hair on the scalp. Under the microscope it is similar to European hair. The head is finely formed, with a high and prominent forehead, and the nose straight and little prominent. The profile reminds one of Greek heads, or of those seen on the monuments of Egyptian priests.

Length of body, 4 feet 10 inches.
Occipital diameter of head, 7¼ inches.
Parietal diameter, 5⅜ inches.

3. *Head of a Mummy.*

The mummy to which this head belonged was probably prepared in the same manner with No. 2, but with less attention to the preservation of the expression of the features, the mouth being distorted and the tongue projecting. The skin has been smeared with resin or bitumen,—there are no indications of spices,—and the cavity of the skull is empty. The jaws are projecting and the brow receding, as in figures of the heads of low-caste Egyptians and modern Fellahs. It is a male head.

Occipital diameter, 7 inches 9 tenths.
Parietal diameter, 5 inches 6 tenths.

4. *Head of a Mummy.*

This head has been completely coated with bitumen, so that the inner cloths adhere and cannot be removed. The interior cavity seems to be partly filled with some solid substance, probably bitumen, which has also penetrated and hardened the tissues of the neck. The head is round, and the features and bones coarse.

Occipital diameter, 7 inches 3 tenths.
Parietal diameter, 6 inches.

These measurements may not be quite accurate, owing to the adhesion of the wrappers.

General Remarks.

No. 1 is preserved in a manner very different from the others and in what appears to be the oldest style of embalming. No bitumen has been used, and the preparatory process has evidently effected the removal rather than the preservation of the more perishable tissues, a result which corresponds very well with the probable results of an alkaline steep like natron, but does not accord with the usual statements of the effect of the process.* The others are prepared in the more usual manner,—with the aid of bitumen, and without the external layer of spices.

The heads of No. 1 and 2 are finely formed, and of the European type. No. 3 is a characteristic elongated African head, and No. 4 is short, and with prominent cheek-bones, tending to a Scythian or American conformation. These differences however are within the limits of those that occur in our own and other modern civilized races. J. W, D.

Note on the Pharonic Lichen, by Prof. Tuckerman, in a letter to one of the Editors:—

"EVERNIA FURFURACEA (L.) *Mann.*—Borrera, *Ach. Lichenogr.;* Parmelia, *Ach. Meth.;* Lichen furfuraceus, *L. and Authors.*

"Inhabits Europe, Asia, Africa, and America. The nearly-allied *E. prunastri* (*L.*) *Ach.* is said to have "a peculiar power of imbibing and retaining odours," and to be "in some request as an ingredient in sweet pots, and ladies' sachets." (Lindley, Fl. Med., p. 628.) It is likely the Egyptians found, or fancied that the present species would do as well; or perhaps they did not distinguish the two. Many now living lichens are probably of great age; but this is the oldest (so far as my knowledge goes) that we have any data about. The specimens would have lasted, so far as appears, almost indefinitely, if undisturbed and left in Egypt. It should be added that medical writers attribute the same value to *E. furfuracea* that they do to *E. prunastri*, and the plants are very likely identical in this respect."

Under the synonym *Physica furfuracea*, Dr. W. L. Lindsay thus speaks of our lichen: †

"It is found abundantly on the Himalayas and in many other parts of the world. From containing a considerable quantity of bitter principle, it has been used as a febrifuge instead of cinchona-bark or quinine. We have found it yield on ammoniacal maceration a red dye. The

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* Herodotus however appears to have been aware of this effect.—B. II., ch. 87.

† Popular History of British Lichens, by W. Lauder Lindsay, M.D London, 1856, Lovell Reeve, 1 vol. 16mo., pp. 352, with 22 col. plates, price 7s. 6d. An excellent little treatise, one of the best of a valuable series, which we take this opportunity of commending to our readers.

Egyptians at one time used it in the baking of bread as a substitute for another species, *P. prunastri*, * * * * for which purpose Forskuel says it (*P. prunastri*) was imported in shiploads from the Archipelago into Alexandria. A handful was steeped two hours in water, and the infusion added to the bread. It has been used also in the making of hair-powders." D. A. P.

List of the Egyptian curiosities recently brought to this City by the Hon. James Ferrier, and presented by him to the Natural History Society.

1	Mummy,	woman, with coffin,	from Thebes,
1	do	man, "	"
2	do	heads,	"
4	do	hands,	"
1	do	foot,	"
2	do	Ibises,	"
1	do	Hawk,	"

4 Small do. Crocodiles.
4 Jars, with the heads of Genii.
2 Jar covers, with heads of deities.
5 Small Jars containing Wheat from Mummy coffins.
2 Mummy shawls or cloths in which the bodies are wrapped.
1 Pair of Sandals, taken from a Mummy.

5 Dates, from date Palm. 1 Date, from Doum Palm. 1 Curious Seed.	From a Mummy Coffin.

4 Necklaces from Mummies, with image of Isis appended.
2 Necklaces from Mummies with Scarabaei.
1 Lamp of the dead, taken from a Coffin.
2 Antique Scarabaei, with extended wings.
1 do. do. of Blue Pottery.
4 do. Rings, taken off Mummies' fingers.
3 Fragments of Bread, with which the dead were supplied, found in a coffin.

1 Bronze Image of the God Osiris. 1 " " of the Goddess Isis, nursing her son Horus.	from Thebes.

1 Papyrus Case, with the God Osiris standing with the Hawk God before him, having the Cartouche of Thothmes III, the Pharaoh of the time of Moses ?
3 pieces Egyptian Writing on Papyrus.
3 Wooden Images of Egyptian Deities, from the Tombs at the great Pyramids of Ghizeh.

2 Stone do of do 8 Pottery do of do	from Tombs at Thebes.

1 Fragment of Statuette, from the Temple of Koorneh, at Thebes.
1 Ivory Carving from a tomb at Thebes.
2 Sun-dried Bricks from Thebes, bearing the Cartouche of Rameses I. (the Great) 1311 B.C.

Halfeh Grass, taken from between the courses of a Brick Pyramid at Thebes, erected 1200 B.C.

1 Glass Eye from Statue of a deity at Thebes.

6 Fragments of Granite Images and Sphynx, from the Temple of Karnak.

2 Fragments of Granite, with Hieroglyphics from Karnak.

1 Fresco Painting, from an Arched Tomb at Dayr El Medeeneh.

6 Fragments of Hieroglyphics, from a Temple at Philæ, built 1500 B.C.

1 Fragment of Carved Pillar from do. do.

1 do of fluted Pillar from Karnak.

1 do of Winged Ibis, "

1 Fragment of Arm with bracelet, from a Statue at the Pyramid of Sakeara.

1 do with hieroglyphics, from the temple of Kom Ombus.

1 do of the Vocal Memnon.

2 do of Alabaster which lines the tombs near the Pyramids of Ghizeh.

2 do Water colour Painted Limestone, taken from an interior chamber in Belzoni's Tomb.

4 do of hieroglyphics from Petamunap's (the Priest's) Tomb at Thebes —this tomb covers an area of 1¼ acres.

1 do of Hieroglyphics from the Temple of Edfoo, U. E.

1 do of Hieroglyphics from the Temple at Karnak.

1 do of the Pyramid of Ghizeh [Nummulite Limestone.]

1 do of Mortar from do.

MODERN CURIOSITIES.

1 Long coloured Necklace from Nubia.

I White Shell do from do.

1 Scarabæus, with hieroglyphics.

1 Nubian girl's dress.

1 do Pillow.

4 Egyptian Water Bottles from Sioot.

2 Nubian Ostrich Eggs, from Assouan.

11 dates from the Doum Palm Tree.

6 Specimens of Nile Mud, from different localities.

2 Nubian Spears.

1 do Bow.

1 do Quiver with 10 arrows.

1 do War Club.

1 small piece of Rope made from the Palm tree.

3 Egyptian Coffee Cups and stands.

1 Crocodile, killed near Kom Ombos.

3 Cones from the Cedars of Lebanon.

2 pieces of Pumice coloured by sulphur, from Mount Vesuvius.

2 fragments of Granite, from the obelisk in the quarries in Assouan. The obelisks at Karnak and the great statue of Rameses at Thebes are the same material.

4 specimens of Flint, from the Theban Mountains at the tombs of the Kings, Thebes

1 specimen of Nummulite Rock from the tombs of Beni Hassan.

7 do of Agates, from the Desert near Beni Hassan.

LIST OF A COLLECTION OF IMPRESSIONS TAKEN FROM THE TEMPLES AND TOMBS OF EGYPT.

Remeses IV., 1189 B.C., from Tomb at Thebes.

Shishak (of Scripture) 990 B.C., from Temple at Karnak.

Remeses VIII., 1171 B.C., from Tomb at Thebes.

Remeses II., 1311 B.C., from Temple at Koorneh, Thebes.

Sethi or Osirei (beloved of Pthah), 1322 B.C., from Belzoni's Tomb Thebes.

Ptolemy Philopater, 221 B.C., from Temple of Dayr el Medeeneh, Thebes.

Osirtasen I., 2020 B.C., from Tomb at Beni Hassan.

Remeses V., 1185 B.C., from Tomb at Thebes.

Thothmes III., 1463 B.C., from Temple of Dayr el Bahree, Thebes.

Remeses VI., 1180 B.C., from Tomb at Thebes.

Pisham, 1004 B.C., from Temple of Karnak.

Ptolemy Philometor, 180 B.C., from Temple of Dayr el Medeeneh, Thebes.

Ptolemy the Elder, 51 B.C., from Temple at Philæ.

Remeses VII, 1176 B.C., from Temple of Koorneh, Thebes.

Sethi or Osirei I., 1322 B.C., from Thebes.

Physcon, 145 B.C., from Temple at Philæ.

Ptolemy Philopator, 121 B.C., do do

Ptolemy Epiphanes, 204 B.C., do do

Nero Cæsar, 37 A.D., from Temple at Dendara.

Tiberius Cæsar, 34 A.D., do do

A Royal Cartouche, from Grottoes at Beni Hassan.

An Offering, from Temple at Dendara.

The Ibis, from Temple of Dayr el Medeeneh, Thebes.

An Offering, from do do do

Sacred Goose, 1185 B.C., from Memnon's Tomb, Thebes.

Scarabæus, from Belzoni's Tomb, Thebes.

Winged Scarabæus, from Temple at Dendara.

Head, from the Tombs of Assaseef, Thebes.

Head, from the Temple at Karnak.

Head, with Sacrificial Knife from Temple at Dendara.

Owl-headed Deity, from Temple at Kom-Ombos.

Head of the Deity of Justice, Dayr el Medeeneh.

Cynocephalue, do do

Hand presenting an Offering, from Temple of Karnak.

Assessor, from Temple of Dayr el Medeeneh, Thebes.

Hieroglyphics, from Grotto at El Kab.

Globes, Asps and Deities from Temple of Karnak.

Cartouche, from Dayr el Medeeneh.

A Judgment Scene from the Temple of Dayr el Medeeneh, copied and awn by Mr. R. W. Ferrier.

ARTICLE XXXI.—*On Ozone.* By CHARLES SMALLWOOD, M.D., LL.D., Professor of Meteorology in the University of McGill College.

(Concluded from page 345.)

In a short paper read before the American Association for the Advancement of Science, at the meeting held in Montreal in 1857, I expressed an opinion that the presence and development of Ozone was always attended by a humid state of the atmosphere, and that observations of the psychrometer led to a certain indication of the presence or absence of Ozone. Since that time upwards of three thousand observations still confirm the opinion then expressed, and it has been shown that Ozone is not formed unless water or the vapor of water is present; for in perfectly dry air no Ozone has been detected. Even when Ozone is chemically formed by the means of phosphorus, its presence ceased to be appreciated in dry atmospheric air; and further when it is decomposed by heat, the vapor which it contained is set free. Phosphorus would seem to effect the combination of the vapor of water with the oxygen. This combination, and change in the particles of vapor, has also been attributed to electrical action.

Impressed, from these observations, with the importance of ascertaining if the corresponding periods of time indicating the greatest amount of humidity in the atmosphere, were really the true time of the daily ozonic periods, observations were instituted here for this purpose, by comparing these periods with other physical phenomena indicating the amount of humidity present. From observations carefully conducted up to the present date, it has been shown that the ozonic periods correspond in a striking degree to the bi-daily variations of the atmospheric humidity. During the progress of these investigations, strips of calico prepared with the starch and iodine solution, seemed to answer the purpose better than the prepared paper, owing, it may be supposed, to the fact that the cotton fibre absorbed with greater facility the moisture present, while at the same time it also seemed to retain the amount of Ozone collected better than the prepared test-paper.

It would seem now desirable to extend these observations, by keeping the ozonized calico always moist, which is easily accomplished by the capillary attraction of the cotton fibre, and thus furnish a medium for the decomposition of the aqueous vapor and the consequent development of Ozone. This should also

be done by making time an element, which would also show the true time of the ozonic daily periods.

The action of direct light upon the ozonized paper would not seem to exert any great influence on the development of Ozone. By exposing the test-papers under different coloured glasses, and also to the action of polarized light, the following were the results. The expression of 1.00 being for saturation gives the ratio exposed to direct light, .73; to polarized light, .64; to white light, .57; to red, .58; to orange, .55; to purple, .51; to blue, .45; and to green, .41.

The following table of the properties of direct light through coloured media, is copied for the sake of comparison:—

	Light.	Heat.	Chemical Action.
White,	7	7	7
Red,	4	5	6
Orange,	6	6	4
Purple,	3	4	6
Blue,	4	3	6
Green,	5	2	3

The whole sunbeam consisting of luminous rays, heating rays, and chemical or actinic rays, light therefore passing through the above coloured media becomes deprived of one or more of these properties. In submitting the test-papers to these different coloured rays, it is shown that light passing through a green medium prevents the formation of ozone in the proportion .41 to .73. Polarized light would seem to possess the least influence on the development of ozone,—it gives in the proportion of .64 to .73. Next comes white light, then red, orange, purple, blue, and green. Green, it may be remarked, possesses but half the chemical or actinic action of red, purple, and blue. Orange, which possesses the greatest amount of luminous and heat rays, gave Ozone in the proportion of .55 to .73

The effects of the germination of plants on the amount of Ozone has also formed a subject of investigation here. The test-papers placed among vegetables and flowers, and also on branches of trees, have up to the present time given no decided results; except that during the prevalence of the potatoe rot, the test-papers placed between the rows of the diseased plant, were much more deeply coloured than those placed in the usual situation. But here, at the period of its outbreak, we had rain followed by a hot sun,—an atmosphere peculiarly suited for the development of

ozone. The influence of vegetation on its amount, whatever it may be during the spring and summer months, becomes sealed up in the icy bonds of winter. Returning spring, with its humid atmosphere, again affords ample means for the prosecution of the subject.

The influence of winds on the amount of ozone depends upon the quarter from which they come. Easterly and southerly winds may be called ozonic winds; while westerly and northerly winds barely indicate a trace. Rain and snow generally indicate a large amount. A north-easterly land-wind does not generally indicate ozone; and whenever there is ozone present during a north-east wind, it may be attributed to the sea-breeze passing over the land; for we have often a *dry* N.E. wind with a high barometer for some days, and no indication of ozone.

Its effects on animals and on the health of man require a system of registration, especially in the latter case, so as to present a comparative scale of disease and death in connection with the amount of ozone presented. During the last visitation of cholera, there was certainly a diminution in the amount; but at the same time there was a diminished amount of humidity. Its highly deleterious effects on the lower classes of animals are well ascertained, and have been turned to advantage in its poisonous properties, when produced by the slow combustion of phosphorus.

As a therapeutic agent, it can scarcely be said to have been administered. Oil of turpentine exposed to light, has acquired a pungent taste like peppermint, owing to the formation of ozone, and has proved poisonous when given to small animals; it has been advised as a local application in rheumatism, and internally in chronic discharges from the mucous membranes in Man.

It is purposed still to prosecute the investigation of the effects of vegetation on the amount of Ozone, and also the effects due to the germination of plants. While the whole of the European continent is studded with observers, we are led to believe that little attention is paid to its investigation on this continent. A constant systematic form of observation is necessary; and it is to be hoped that but a few more years will pass before it takes its proper place in the annals of true science, and becomes alike interesting to the chemist, the physician, and the meteorologist.

St. Martin, Isle Jesus, Nov. 16, 1859.

ARTICLE XXXII.—*Notes on Land and Sea Birds observed around Quebec.* By J. M. Le Moine.

(Presented to the Natural History Society.)

The plan followed by G. W. Allan, Esq., of Toronto, and W. S. M. D'Urban, Esq., of Montreal, of noting down *seriatim* the habits of land-birds, observed in the vicinity of those respective cities in 1853 and in 1856–7, seems well calculated to throw additional light on the Canadian Fauna, yet so imperfectly known.

I intend briefly to notice the birds which are common to the Quebec, as well as to the Montreal District, together with some other facts connected with the natural history of the country generally.

Surnia nyctea, the Snowy Owl, and *Syrnium nebulosum*, the Barred Owl.—Both very common in the country parts of this district. In March, their hooting is very familiar to those engaged in maple-sugar making on the slopes of the mountains. The burning of old leather in the sugar hut—is sure to call forth the snowy owl's most dismal notes, especially after nightfall.

Corythus Enucleator, Pine Grosbeak.—Plentiful in the winter season, when they live on the berries of the mountain ash.

Turdus migratorius, Linn., Robin.—Abundant in the month of May all round Quebec; nowhere, however, have I seen them in such numbers as in Gaspé, some years back. At the time I allude to, they were shot by dozens at Point St. Peter, Gaspé, in May and June, under the flakes, where they were attracted by the fish maggots which fell from the spruce boughs where the codfish were drying. In July they took to the woods to build.

On the 2nd January, 1858, whilst driving, in company with a friend, past Woodfield, near Quebec, the country seat of the late James Gibb, I noticed a very fine male robin on a pine tree. Robins, to a certainty, do not winter in this district. Whence came the interesting stranger, has ever to me been a subject of speculation and fruitless enquiry. Still I was too close to mistake an old friend. The Canada Robin, Bob-o-link, and Wood-thrush, are, in my opinion, our best songsters. Several of our land-birds have exquisitely rich plumage, such as the scarlet bird, "le roi des oiseaux," to be found in the depths of the forest; the Indigo bird, common on the mountains and behind Montreal; the *Pivart*, all three old inhabitants of the country, as appears on reference to the description of Canada birds written in 1663, by

Pierre Boucher, the Governor of Three Rivers, in the "Histoire Naturelle du Canada." This small and interesting volume was prepared by the old governor for the information and amusement of his friends at the court of Louis XIV. In treating on the subject, I cannot refrain from comparing notes with the old chronicler. At pages 34 and 35 he states that "amongst the birds which are daily shot in Canada," there are ten kinds of divers, "swans and cranes." As to swans, we can lay claim to the white swan only, the black or Australian swan never having, that I am aware of, been seen in this country. The white swan is tolerably scarce now, however numerous the species may have been when Governor Boucher wrote. A very magnificent specimen, shot at Crane Island about 1825, was subsequently presented to the Governor General, by D. McPherson, Esq., the seigneur of the island. The beautiful stranger was, I believe, preserved by Chasseur, and measured six feet from wing to wing. As to cranes, they seem to us foreign birds as they were to the Romans: "*gruem advenam.**" Until a year or two back, two solitary wanderers were frequently seen during July and August of every year, feeding on the vast swamp which unites Crane to Goose island. More than one sportsman tried to get within shot, but these birds, which stood six feet high, were too watchful. Boucher also mentions bitterns, snipes, woodcocks, jack-snipes, sand-pipers or sea-larks, as he calls them, but says there are no field-larks; in this he is mistaken. Among other Canada birds, such as the *Utarde*, wild white goose, and fifteen species of birds of prey, he makes mention of the wild turkey, not however, he adds, "to be found either at Quebec, Three Rivers, or Montreal, but only in the regions inhabited by the Iroquois or Mohawks, where they are very numerous, and counted a delicious food." I believe the habitat of this noble bird is restricted entirely to the far west, Port Sarnia, &c. In noticing the wild turkey and Boucher's volume, I am led to point out an error committed by that benefactor of the human race, Brillat-Savarin, in his philosophical essay on gastronomy, "Physiologie du Goût;" after setting forth the common opinion respecting turkeys, viz. that turkeys were known to the Romans, that turkeys were served at Charlemagne's nuptials; he attempts to discredit this opinion, and asserts that such is not the case; that turkeys were imported from America to France by the Jesuits, about the end of the seventeenth century; that the

* Horace, Epodon Lib. Od. 2.

Jesuits reared a great number on a farm they had near Bourges, in France; that this is one amongst the many blessings the Jesuits showered on France, and that this fact was so well known to the French people, that the common folk were in the habit of calling a turkey, "un Jesuite," a Jesuit. Notwithstanding the profound respect I entertain for Brillat-Savarin as an oracle second to none on points connected with gastronomy, I think his theory falls to the ground, since, far from having been imported into France about the end of the seventeenth century, Governor Boucher, in 1663, speaks of the "domestic turkey," as common in France long before he wrote. *

This old writer makes mention also of three kinds of partridges in Canada, the black or spruce with red eyes, the brown partridge or grouse (*Tetrao umbellus*), and the ptarmigan (*Tetrao lagopus*) or Hudson's Bay partridge, a most beautiful bird, entirely guided in its migration by laws of climate. It is seen near Quebec only when the winter is unusally severe, and was frequently for sale on our markets last winter; several were shot within a few miles of the city limits. This species had not before been seen since the winter of 1844, a very rigorous season. Nothing short of arctic cold will bring this snowy visitor from its northern fastnesses.

Little seems to be known concerning the breeding place of the *Utarde*. Many imagine they lay their eggs on small wooded islands in the northern lakes of the Saguenay district. Large flocks are seen winging their *wedge-like* flight over Cape aux Oies, on the north shore of the St. Lawrence.

The wild duck, until lately, was in the habit of rearing its young brood on the Crane Island swamps, and Sorel Islands, where the young birds, before they could fly, were caught with the assistance of dogs. Incessant annoyance has, however, driven them away from their old breeding places, except from the Sorel Islands, where they still breed. There is one of the Canada ducks, of which the country is justly proud; that is, the Wood-duck, a most gorgeously dressed individual, whose head quarters seem to be the Sorel Islands and the Upper Canada lakes.

I must not omit a singular occurrence during the late severe winter. Notwithstanding the inclemency of the weather, the

* Our correspondent of course does not intend to maintain that the Turkey, a strictly American bird, was known in Europe before the discovery of America.—(Eds.)

Canadian Linnet, contrary to its custom, was to be found in the woods, and was caught, and sold in the markets. Much inferior to the English linnet, still the song of this species is musical and agreeable.

Emberiza nivalis, Snow Bunting.—Very abundant all winter. One person in the Island of Orleans trapped in four days last winter sixty dozen. There is in Canada a bird of the size of the snow-bird, to be found in the flocks of snow-birds. The country folks call it *Ortolan de Niege;* it is prettily variegated with brown, white, and yellow.* Unlike the snow-bunting, it never roosts on trees, and is easily domesticated. Its note is a low, continuous warble, very pleasing to the ear, particularly so when proceeding from a flock of these birds feeding in a stubble field, their usual haunt, a few hours before sunset in April.

ARTICLE XXXIII.—*On Some Points in Chemical Geology.* By T. Sterry Hunt, M.A., F.R.S., of the Geological Commission of Canada.†

I. In a paper read before the American Association at Montreal in August 1857, as also in some previous communications to the Royal Society, and in the Report of the Geological Survey of Canada for 1856, I have endeavoured to explain the theory of the transformation of sedimentary deposits into crystalline rocks. In considering this process we must commence by distinguishing between the local metamorphism which sometimes appears in the vicinity of traps and granites, and that normal metamorphism which extends over wide areas, and is apparently unconnected with the presence of intrusive rocks. In the former case, however, we find that the metamorphosing influence of intrusive rocks is by no means constant, showing that their heat is not the sole agent in alteration, while in the latter case different strata are often found affected in

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* No doubt Phileremus cornutus, Bon. Alanda alpestris, Wils.—Eds.

† This paper, written and sent to the Geological Society of London in August 1858, was not read before that body until the 5th of January 1859. An abstract of it appears in the proceedings of the Society in the *Philosophical Magazine* for February, and it is published at length in the *Quarterly Journal of the Geological Society* for November 1859, pp. 488–496, from which it is now reprinted, with the addition, by the author, of a few notes, which are distinguished from those before published by being enclosed in brackets.

very different degrees; so that fossiliferous beds but little altered are sometimes found beneath crystalline schists, or even intercalated with them.

We cannot admit that the alteration of the sedimentary rocks has been effected by a great elevation of temperature, approaching, as many have imagined, to that of igneous fusion; for we find unoxidized carbon, in the form of graphite, both in crystalline limestone and in beds of magnetic iron-ore; and it is well known that these substances, and even the vapour of water, oxidize graphite at a red heat, with formation of carbonic acid or carbonic oxide. I have however shown that solutions of alkaline carbonates in presence of silica and earthy carbonates slowly give rise to silicates, with disengagement of carbonic acid, even at a temperature of 212° Fahr.,—the alkali being converted into a silicate, which is then decomposed by the earthy carbonate, regenerating the alkaline salt, which serves as an intermedium between the silica and the earthy base. I have thus endeavoured to explain the production of the various silicates of lime, magnesia and oxide of iron so abundant in crystalline rocks, and with the intervention of the argillaceous element, the formation of chlorite, garnet and epidote.† I called attention to the constant presence of small portions of alkalies in insoluble combination in these silicates, both natural and artificial—a fact which had already led Kuhlmann to conclude that alkaline silicates have played an important part in the formation of many minerals; and I suggested‡ that, by combining with alkalies, clays might yield feldspars and micas, which are constantly associated in nature with the silicates above mentioned. This suggestion has since been verified by Daubrée,§ who has succeeded in producing feldspar by heating together for some weeks to 400° C. mixtures of kaolin and alkaline silicates in the presence of water.

The problem of the generation from the sands, clays and earthy carbonates of sedimentary deposits, of the various silicious minerals which make up the crystalline rocks, may now be regarded as solved, and we find the agent of the process in waters holding in solution alkaline carbonates and silicates, acting upon the heated strata. These alkaline salts are constantly produced by the slow decomposition of feldspathic sediments, and are met with alike in the waters of

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†Proceedings of the Royal Society, May 7, 1857.
‡Report Geol. Surv. Canada, 1856, p. 479.
§Bull. Soc. Géol. de France (2) vol. xv. p. 103.

the unaltered Silurian schists of Canada, and of the secondary strata of the basins of London and Paris. In the purer limestones however, the feldspathic or alkaliferous elements are wanting; and these strata often contain soluble salts of lime or magnesia. These would neutralize the alkaline salts, which infiltrating from adjacent strata, might otherwise effect the transformation of the foreign matters present in the limestones into crystalline silicates. By a similar process these calcareous or magnesian salts, penetrating the adjoining strata, would retard or prevent the alteration of the latter. These considerations will serve to explain the anomalies presented by the comparatively unaltered condition of some portions of the strata in metamorphic regions.||

II. As the history of the crystalline rocks becomes better known, we find that many which were formerly regarded as exclusively of plutonic origin are also represented among altered sedimentary strata. Crystalline aggregates of quartz and feldspar with mica offer transitions from mica-schist, through gneiss, to stratified granites, while the pyroxenic and hornblendic rocks of the altered Silurian strata of Canada pass, by admixtures of anorthic feldspars, into stratified diorites and greenstones. In like manner the interstratified serpentines of these regions are undoubtedly indigenous rocks, resulting from the alteration of silico-magnesian sediments, although the attitude of the serpentines in many countries has caused them to be ranked with granites and traps, as intrusive rocks. Even the crystalline limestones of the Laurentian series, holding graphite and pyroxene, are occasionally found enveloping broken beds of

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|| De Senarmont[1] in his researches on the artificial formation of the minerals of metalliferous veins by the moist way, has shown that by aid of heated solutions of alkaline bicarbonates and sulphurets, under pressure at temperatures of 200° or 300° C., we may obtain in a crystalline form many native metals, sulphurets, and sulpharseniates, besides quartz, fluor-spar and sulphate of barytes.

Daubrée[2] has since shown that a solution of a basic alkaline silicate deposits a large portion of its silica in the form of crystalline quartz when heated to 400° C. We have here, beyond a doubt, a key to the true theory of metalliferous veins. The heated alkaline solutions, which are at the same time the agents of metamorphism, dissolve from the sediments the metallic elements which these contain disseminated, and subsequently deposit them with quartz and the various spars in the fissures of the rock.

[1]Ann. de Chim. et de Phys. (3), vol. xxxii, p. 129,
[2]Bull. Soc. Géol. de France (2), vol. xv, p. 99.

quartzite, or injected among the fissures in adjacent silicious strata. From similar facts, observers in other regions have been led to assign a plutonic origin to certain crystalline limestones. We are thus brought to the conclusion that metamorphic rocks, such as granite, diorite, dolerite, serpentine, and limestone, may under certain conditions, appear as intrusive rocks. The pasty or semi-fluid state which these rocks must have assumed at the time of their displacement is illustrated by the observations of Daubrée upon the swelling up of glass and obsidian, and the development of crystals in their mass under the action of heated water, indicating a considerable degree of mobility among the particles. The theory of igneo-aqueous fusion applied to granites by Poulett Scrope and Scheerer, and supported by Elie de Beaumont and by the late microscopic observations of Sorby, should evidently be extended to other intrusive rocks; for we regard the latter as being in all cases altered and displaced sediments.

III. The silico-aluminous rocks of plutonic and volcanic origin are naturally divided into two great groups. The one is represented by the granites, trachytes and obsidians, and is distinguished by containing an excess of silica, a predominance of potash, and only small portions of soda, lime, magnesia and oxide of iron. In the other group silica is less abundant, and silicates of lime, magnesia and iron predominate, together with anorthic feldspars, containing soda and but little potash. To account for the existence of these two types of plutonic rocks, Prof. J. Phillips supposes the fluid mass beneath the earth's crust to have spontaneously separated into a lighter, silicious, and less fusible layer, overlying a stratum of denser basic silicates. In this way he explains the origin of the supposed granitic substratum, of the existence of which however, the study of the oldest rocks affords no evidence. From these two layers, occasionally modified by admixtures, and by partial separation by crystallization and eliquation, Prof. Phillips suggests that we may derive the different igneous rocks. Bunsen and Durocher have adopted, with some modifications, this view; and the former has even endeavoured to calculate the composition of the normal trachytic and pyroxenic magmas (as he designates the two supposed zones of fluid matter underlying the earth's crust), and then seeks, from the proportion of silica in any intermediate species of rock, to deduce the quantities of alkalies, lime, magnesia and iron which this should contain.

So long as the trachytic rocks are composed essentially of ortho-

clase and quartz, and the pyroxenic rocks of pyroxene and labradorite, or a feldspar approaching it in composition, it is evident that the calculations of Bunsen will to a certain extent hold good; but in the analyses, by Dr. Streng, of the volcanic rocks of Hungary and Armenia, we often find that the actual proportions of alkalies, lime, and magnesia vary considerably from those deduced from calculation. This will necessarily follow when feldspars like albite or anorthite replace the labradorite in pyroxenic rocks. The phonolites are moreover highly basic rocks, which contain but very small amounts of lime, magnesia, or iron, being essentially mixtures of orthoclase with hydrous silicates of alumina and alkalies.

IV. In a recent enquiry into the probable chemical conditions of a cooling globe like our earth, I have endeavoured to show that in the primitive crust all the alkalies, lime and magnesia must have existed in combination with silica and alumina, forming a mixture which perhaps resembled dolerite, while the very dense atmosphere would contain in the form of acid gases, all the carbon, chlorine and sulphur, with an excess of oxygen, nitrogen and watery vapour. The first action of a hot acid rain, falling upon the yet uncooled crust, would give rise to chlorids and sulphates, with separation of silica; and the accumulation of the atmospheric waters would form a sea charged with salts of soda, lime, and magnesia. The subsequent decomposition of the exposed portions of the crust, under the influence of water and carbonic acid, would transform the felspathic portions into a silicate of alumina (clay) on the one hand, and alkaline bicarbonates on the other; these, decomposing the lime-salts of the sea, would give rise to alkaline chlorids and bicarbonate of lime—the latter to be separated by precipitation, or by organic agency, as limestone. In this way we may form an idea of the generation from a primitive homogeneous mass, of the siliceous, calcareous and argillaceous elements which make up the earth's crust, while the source of the vast amount of carbonate of lime in nature is also explained.*

When we examine the waters charged with saline matters which impregnate the great mass of calcareous strata constituting in Canada the base of the Silurian system, we find that only about one-half of the chlorine is combined with sodium; the remainder exists as chlorids of calcium and magnesium, the former predominating,—while sulphates are present only in small amount. If now we compare this composition, which may be regarded as representing that of the

* Am. Jour. Sci. (2) xxv. 102, and Canadian Journal for May 1858.

palæozoic sea, with that of the modern ocean, we find that the chlorid of calcium has been in great part replaced by common salt, —a process involving the intervention of carbonate of soda, and the formation of carbonate of lime. The amount of magnesia in the sea, although diminished by the formation of dolomites and magnesite, is now many times greater than that of the lime ; for so long as chlorid of calcium remains in the water, the magnesian salts are not precipitated by bicarbonate of soda.*

When we consider that the vast amount of argillaceous sedimentary matter in the earth's strata has doubtlessly been formed by the same process which is now going on, viz. the decomposition of feldspathic minerals, it is evident that we can scarcely exaggerate the importance of the part which the alkaline carbonates, formed in this process, must have played in the chemistry of the seas. We have only to recall waters like Lake Van, the natron lakes of Egypt, Hungary and many other regions, the great amounts of carbonate of soda furnished by springs like those of Carlsbad and Vichy, or contained in the waters of the Loire, the Ottawa, and probably many other rivers that flow from regions of crystalline rocks, to be reminded that the same process of decomposition of alkaliferous silicates is still going on.

V. A striking and important fact in the history of the sea, and of all alkaline and saline waters, is the small proportion of potash-salts which they contain. Soda is pre-eminently the soluble alkali ; while the potash in the earth's crust is locked up in the form of insoluble orthoclase, the soda-feldspars readily undergo decomposition. Hence we find in the analyses of clays and argillites, that of the alkalies which these rocks still retain, the potash almost always predominates greatly over the soda. At the same time these sediments contain silica in excess, and but small portions of lime and magnesia. These conditions are readily explained when we consider the nature of the soluble matters found in the mineral waters which issue from these argillaceous rocks. I have elsewhere shown that, setting aside the waters charged with soluble lime and magnesia salts, issuing from limestones, and from gypsiferous and saliferous formations, the springs from argillaceous strata are marked by the predominance of bicarbonate of soda, often with portions of silicate and borate, besides bicarbonates of lime and magnesia, and occasionally of iron. The atmospheric waters filtering through such strata remove soda, lime and magnesia, leaving behind the silica, alumina and

* See Report Geol. Surv. Canada, 1857, pp. 212–214, and Am. Jour. Science (2) xxviii. pp. 170 and 305.

potash—the elements of granitic and trachytic rocks. The more sandy clays and argillites being most permeable, the action of the infiltrating waters will be more or less complete; while finer and more compact clays and marls, resisting the penetration of this liquid, will retain their soda, lime and magnesia, and by subsequent alteration, will give rise to basic feldspars containing lime and soda, and if lime and magnesia predominate, to hornblende or pyroxene.

The presence or absence of iron in sediments demands especial consideration, since its elimination requires the interposition of organic matters, which by reducing the peroxide to the condition of protoxide, render it soluble in water, either as a bicarbonate or combined with some organic acid. This action of waters holding organic matter upon sediments containing iron-oxide has been described by Bischof and many other writers, particularly by Dr. J. W. Dawson† in a paper on the colouring matters of some sedimentary rocks, and is applicable to all cases where iron has been removed from certain strata and accumulated in others. This is seen in the fire-clays and iron-stones of the coal-measures, and in the white clays associated with great beds of green-sand (essentially a silicate of iron,) in the cretaceous series of New Jersey. Similar alternations of white feldspathic beds with others of iron ore occur in the altered Silurian rocks of Canada, and on a still more remarkable scale in those of the Laurentian series. We may probably look upon the formation of beds of iron-ore as in all cases due to the intervention of organic matters, so that its presence, not less than that of graphite, affords evidence of the existence of organic life at the time of the deposition of these old crystalline rocks.

The agency of sulphuric and muriatic acids, from volcanic and other sources, is not however to be excluded in the solution of oxide of iron and other metallic oxides. The oxidation of pyrites, moreover, gives rise to solutions of iron and alumina salts, the subsequent decomposition of which by alkaline or earthy carbonates will yield oxide of iron and alumina; the absence of the latter element serves to characterize the iron-ores of organic origin.‡ In this way the deposits of emery, which is a mixture of crystallized alumina with oxide of iron, have doubtless been formed.

† Quart. Journ. Geol. Soc., vol. v, p. 25.

[‡ Hydrated alumina in the form of gibbsite is however met with incrusting limonite, and the existence of compounds like pigotite, in which alumina is united with an organic substance allied to crenic acid, seems to show that this base may, under certain conditions, be taken into solution by organic acids.]

Waters deficient in organic matters may remove soda, lime and magnesia from sediments, and leave the granitic elements intermingled with oxide of iron; while on the other hand, by the admixture of organic materials, the whole of the iron may be removed from strata which will still retain the lime and soda necessary for the formation of basic feldspars. The fact that bicarbonate of magnesia is much more soluble than bicarbonate of lime, is also to be taken into account in considering these reactions.

The study of the chemistry of mineral waters, in connexion with that of sedimentary rocks, shows us that the result of processes continually going on in nature is to divide the silico-argillaceous rocks into two great classes,—the one characterized by an excess of silica, by the predominance of potash, and by the small amounts of lime, magnesia and soda, and represented by the granites and trachytes, while in the other class silica and potash are less abundant, and soda, lime and magnesia prevail, giving rise to pyroxenes and triclinic feldspars. The metamorphism and displacement of sediments may thus enable us to explain the origin of the different varieties of plutonic rocks without calling to our aid the ejections of the central fire.

VI. The most ancient sediments, like those of modern times, were doubtlessly composed of sands, clays, and limestones, although from the principles already defined in IV. and V., it is evident that the chemical composition of these sediments in different geologic periods must have been gradually changing. It is from a too hasty generalization that an eminent geologist has concluded that limestones were rare in earlier times, for in Canada the Laurentian system—an immense series of stratified crystalline rocks which underlie unconformably both the Silurian and the old Cambrian or Huronian systems—contains a limestone formation (interstratified with dolomites), the thickness of which Sir W. E. Logan has estimated at not less than 1000 feet. Associated with this, besides great volumes of quartzite and gneiss, there is a formation of vast but unknown thickness, the predominant element of which is a triclinic feldspar, varying in composition between anorthite and andesine, and containing lime and much soda, with but a small proportion of potash. These feldspars are often mixed with hypersthene or pyroxene; but great masses of the rock are sometimes nearly pure feldspar. These feldspathic rocks, as well as the limestones, are associated with beds of hematitic and magnetic iron-ores, the latter often mixed with graphite. Ancient as are these Laurentian rocks

we have no reason to suppose that they mark the commencement of sedimentary deposits; they were doubtlessly derived from the ruins of other rocks in which the proportion of soda was still greater; and the detritus of these Laurentian felspars, making up our palæozoic strata, is now the source of alkaline waters by which the soda of the silicates, rendered soluble, is carried down to the sea in the form of carbonate to be transformed into chlorid of sodium. The lime of the feldspars being at the same time removed as carbonate, these sedimentary strata in the course of ages become less basic, poorer in soda and lime, and comparatively richer in alumina, silica, and potash. Hence in more recent crystalline rocks we find a less extensive development of soda-feldspars, while orthoclase and mica, chlorite and epidote, and silicates of alumina, like chiastolite, kyanite, and staurotide, which contain but little or no alkali, and are rare in the older rocks, become abundant.

The decomposition of the rocks is more slow now than formerly, because soda-silicates are less abundant, and because the proportion of carbonic acid in the air (an efficient agent in these changes,) has been diminished by the formation of limestones and coal. It will be evident that the principles above laid down are only applicable to the study of rocks in great masses, and refer to the predominance of certain mineral species at certain geologic epochs, since local and exceptional causes may reproduce in different epochs the conditions which belong to other periods.

VII. Mr. Babbage§ has shown that the horizons or surfaces of equal temperature in the earth's crust must rise and fall, as a consequence of the accumulation of sediment in some parts and its removal from others, producing thereby expansion and contraction in the materials of the crust, and thus giving rise to gradual and wide-spread vertical movements. Sir John Herschel‖ subsequently showed that, as a result of the internal heat thus retained by accumulated strata, sediments deeply enough buried will become crystallized and ultimately raised, with their included water, to the melting point. From the chemical reactions at this elevated temperature, gases and vapours will be evolved, and earthquakes and volcanic eruptions will result. At the same time the disturbance of the equilibrium of pressure consequent upon the transfer of sediments, while the yielding surface reposes upon a mass of matter partly liquid and partly solid, will enable us to explain the phenomena of elevation and subsidence.

§ "On the Temple of Serapis." Proc. Geol. Soc., vol. ii, p. 73.

‖ Ibid. vol. ii, pp. 548 & 596.

According, then, to Sir J. Herschel's view, all volcanic phenomena have their source in sedimentary deposits; and this ingenious hypothesis, which is a necessary consequence of a high central temperature, explains in a most satisfactory manner the dynamical phenomena of volcanoes, and many other obscure points in their history, as for instance, the independent action of adjacent volcanic vents, and the varying nature of their ejected products. Not only are the lavas of different volcanoes very unlike, but those of the same crater vary at different times; the same is true of the gaseous matters, hydrochloric, hydrosulphuric, and carbonic acids. As the ascending heat penetrates saliferous strata, we shall have hydrochloric acid, from the decomposition of sea-salt by silica in the presence of water; while gypsum and other sulphates, by a similar reaction, would lose their sulphur in the form of sulphurous acid and oxygen. The intervention of organic matters, either by direct contact, or by giving rise to reducing gases, would convert the sulphates into sulphurets, which would yield sulphuretted hydrogen when decomposed by water and silica or carbonic acid, the latter being the result of the action of silica upon earthy carbonates. We conceive the ammonia so often found among the products of volcanoes to be evolved from the heated strata, where it exists in part as ready-formed ammonia (which is absorbed from air and water, and pertinaciously retained by argillaceous sediments), and is in part formed by the action of heat upon azotized organic matter present in these strata, as already maintained by Bischof.* Nor can we hesitate to accept this author's theory of the formation of boracic acid from the decomposition of borates by heat and aqueous vapour.†

The almost constant presence of remains of infusorial animals in volcanic products, as observed by Ehrenberg, is evidence of the interposition of fossiliferous rocks in volcanic phenomena.

The metamorphism of sediments *in situ*, their displacement in a pasty condition from igneo-aqueous fusion as plutonic rocks, and their ejection as lavas with attendant gases and vapours are, then, all results of the same cause, and depend upon the differences in the chemical composition of the sediments, the temperature, and the depth to which they are buried: while the unstratified nucleus of the earth, which is doubtless anhydrous, and according to the calculations of Messrs. Hopkins and Hennessey, probably solid to a great

* Lehrbuch der Geologie, vol. ii, pp. 115–122.

† Ibid. vol i, p. 669.

depth, intervenes in the phenomena under consideration only as a source of heat.‡

VIII. The volcanic phenomena of the present day appear, so far as I am aware, to be confined to regions covered by the more recent secondary and tertiary deposits, which we may suppose the central heat to be still penetrating (as shown by Mr. Babbage), a process which has long since ceased in the palæozoic regions. Both normal metamorphism and volcanic action are generally connected with elevations and foldings of the earth's crust, all of which phenomena we conceive to have a common cause, and to depend upon the accumulation of sediments and the subsidence consequent thereon, as maintained by Mr. James Hall in his theory of mountains. The mechanical deposits of great thickness are made up of coarse and heavy sediments, and by their alteration yield hard and resisting rocks; so that subsequent elevation and denudation will expose these contorted and altered strata in the form of mountain-chains. Thus the Appalachians of North America mark the direction and extent of the great accumulation of sediments by the oceanic cur-

[‡The notion that volcanic phenomena have their seat in the sedimentary formations of the earth's crust, and are dependant upon the combustion of organic matters, is as Humboldt remarks, one which belongs to the infancy of geognosy (*Cosmos*, vol. v, p. 443. Otte's translation). In 1834 Christian Keferstein published his *Naturgeschichte des Erdkörpers*, in which he maintains that all crystalline non-stratified rocks, from granite to lava, are products of the transformation of sedimentary strata, in part very recent, and that there is no well-defined line to be drawn between neptunian and volcanic rocks, since they pass into each other. Volcanic phenomena according to him have their origin, not in an igneous fluid centre, nor an oxydizing metallic nucleus, but in known sedimentary formations, where they are the result of a peculiar process of fermentation, which crystallizes and arranges in new forms the elements of the sedimentary strata, with evolution of heat as an accompaniment of the chemical process. (*Naturgeschichte*, vol. 1 p. 109, also *Bull. Soc. Géol. de France* (1) vol. vii. p. 197.)

These remarkable conclusious were unknown to me at the time of writing this paper, and seem indeed to have been entirely overlooked by geological writers; they are, as will be seen, in many respects an anticipation of the views of Herschel aud my own; although in rejecting the influence of an incandescent nucleus as a source of heat, he has, as I conceive, excluded the exciting cause of that chemical change, which he has not inaptly described as a process of fermentation, and which is the source of all volcanic and plutonic phenomena. See in this connection my paper on the Theory of Igneous Rocks and Volcanoes, in the Canadian Journal for May, 1858.]

rents during the whole palæozoic period; and the upper portions of these having been removed by subsequent denudation, we find the inferior members of the series transformed into crystalline stratified rocks.§

[§ The theory that volcanic mountains have been formed by a sudden local elevation or tumefaction of previously horizontal deposits of lava and other volcanic rocks, in opposition to the view of the older geologists who supposed them to have been built up by the accumulation of successive eruptions, although supported by Humboldt, Von Buch, and Elie de Beaumont, has been from the first opposed by Cordier, Constant Prevost, Scrope and Lyell. (See Scrope, *Geol. Journal*, vol. xii, p. 326, and vol. xv. p. 500; also Lyell, *Philos. Trans.* part 2, vol. cxlviii, p. 703, for 1858.) In these will we think be found a thorough refutation of the elevation hypothesis and a vindication of the ancient theory.

This notion of paroxysmal upheaval once admitted for volcanoes was next applied to mountains which, like the Alps and Pyrenees, are composed of neptunian strata. Against this view, however, we find De Montlosier in 1832 maintaining that such mountains are to be regarded as the remnants of former continents which have been cut away by denudation, and that the inversions and disturbances often met with in the structure of mountains are to be regarded only as local accidents. (*Bul. Soc. Geol.*, (1) vol. ii, p. 438, vol. iii, p. 215.)

Similar views were developed by Prof. James Hall in his address before the American Association for the Advancement of Science, at Montreal in August 1857. This address has not been published, but they are reproduced in the first volume of his *Report on the Geology of Iowa*, p. 41. He there insists upon the conditions which in the ancient seas gave rise to great accumulations of sediment along certain lines, and asserts that to this great thickness of strata, whether horizontal or inclined, we are to ascribe the mountainous features of North Eastern America as compared with the Mississippi valley. Mountain heights are due to original depositions and subsequent continental elevation, and not to local upheaval or foldings, which on the contrary, give rise to lines of weakness, and favor erosion, so that the lower rocks become exposed in anticlinal valleys, while the intermediate mountains are found to be capped with newer strata.

In like manner J. P. Lesley asserts that "mountains are but fragments of the upper layers of the earth's crust," lying in synclinals and preserved from the general denudation and translation. (*Iron Manufacturer's Guide*, 1859, p. 53.)]

ARTICLE XXXIV.—*Fossils of the Chazy Limestone, with descriptions of new species.* By E. BILLINGS.

(Extracted from the Report of the Geological Survey of Canada for 1858-59.)

The following paper contains an enumeration of the species of organic remains known to occur in the Chazy formation in Canada, so far as they can be ascertained from the collections made, up to the present date. The total number of species is 129, and they may be distributed as follows :—

	Species in Chazy Formation.	Species that pass upward.
Zoophyta	6	1
Cystideæ	7	0
Crinoideæ	14	0
Brachiopoda	21	8
Bryozoa,	4	?
Lamellibranchiata	17	1
Gasteropoda	21	4
Heteropoda	5	0
Cephalopoda	15	4
Trilobites	14	2
Entomostraca	4	1
Serpulites	1	0
	129	21

The species which pass upwards into the overlying formations are *Stenopora fibrosa*, *Lingula Huronensis*, *Strophomena alternata*, *S. incrassata*, *Orthis disparalis*, *O. perveta*, *O. subæquata*, *O. gibbosa*, *O. borealis*, *Ctenodonta nasuta*, *Helicotoma umbilicata*, *Murchisonia perangulata*, *Maclurea Logani*, *M. Magna*, *Orthoceras multicameratum*, *O. bilineatum*, *O. Allumettense*, *O. Minganense*, *Illœnus arcturus*, *Asaphus platycephalus* (?), *Leperditia fabulites* (Conrad), var. (*nana*), Jones.

The genera, with the exception of some of those of the Cystideæ and Crinoideæ, all pass upwards into the more recent formations. The genus *Amphion* has not been found in any higher rocks in Canada; but I think I have read an account somewhere of its occurrence in the blue limestone of the Western States. The genera of Cystidea, which thus far we find peculiar to the Chazy, are *Malocystites* and *Palæocystites*. *Glyptocystites* passes upwards into the Trenton, and I have also seen fragments of what I think a species of *Pleurocystites* in the Chazy. Of the crinoidal genera,

we have *Hybocrinus* and *Rhodocrinus*, and without much doubt also *Glytocrinus and Dendrocrinus* in the Chazy; but *Palæocrinus*, *Pachyocrinus*, and *Blastoidocrinus* are not yet known in higher rocks. Nearly all the species are confined to that part of the country which lies east of Kingston. West of that city, nineteen of the species above given in the list of those that are common to the Chazy and higher rocks, have been found, and also *R. plena* and *M. parviuscula*. Out of 129 species, only 21 have been found west of Kingston.

Pleurotomaria staminea and *Bellerophon sulcatinus* have not been seen in the Chazy in Canada; but they both occur in the Black River.

I think it more than probable that when the fossils of these rocks shall have become better known, the above results will be modified somewhat; but to no great extent. It must be always borne in mind that many of the species are represented by mere fragments, and that although we are able in general to shew that they are distinct, yet they do not furnish the data for detailed specific descriptions. I shall, not therefore, for the present, name those imperfect specimens.

ZOOPHYTA. 6 Species.

STENOPORA FIBROSA. (Goldfuss. s.p.)

Chætetes lycoperdon,—branched variety.

This species is very abundant in the Chazy limestone in several localities on the island of Montreal, but more particularly about half a mile east of the village of St. Laurent. It also occurs at the Mingan Islands in the same formation. There is apparently no difference between the Chazy and Trenton specimens.

STENOPORA PATULA. (N.s.)

Description.—This species which perhaps should be regarded as only a variety of *Stenopora petropolitana*, consists of broad flat irregular expansions from one to six inches in diameter and from one fourth of an inch to one inch in thickness. The tubes are about the size of those of *S. fibrosa.*

Locality and formation.—Island of Montreal. Chazy. Not common.

STENOPORA ADHÆRENS. (N.s.)

Description.—Corallum consisting of wide flattened thin masses, usually incrusting other fossils and sometimes composed of successive layers. The cells in such specimens as I have seen are

about one tenth of a line in diameter. I am not sure that this species should be referred to the genus *Stenopora*. It requires further examination.

Locality and formation.—Mingan Islands. Chazy limestone.

Collectors—Sir W. E. Logan. J. Richardson.

COLUMNARIA PARVA. (N.s.)

Description.—This species occurs in large, globular, irregular, pyriform or wide depressed convex masses with the corallites about one third of a line in diameter. The interior of the tubes do not in general exhibit any radiating septa, but when well preserved and weathered out, the septa are distinctly visible, usually as more or less elevated vertical lines on the inner surface. In some specimens or in different parts of the same, the septa being more perfectly preserved, are seen extending nearly to the centre. There appear to be eight or ten of them. The corallites are generally five or six sided, and the size appears to be pretty uniform, at least it is so in all that I have seen. Some of the flattened masses appear to have been more than one foot wide, and often they have a thin stratified structure or are composed of successive layers, the divisional planes between which divide the corallites at right angles. There are three or four transverse septa in one line.

Locality and formation.—Mingan Islands. Chazy limestone.

Collectors.—Sir W. E. Logan. J. Richardson.

COLUMNARIA INCERTA. (N.s.)

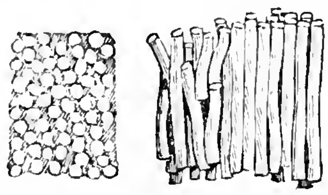


Fig. 1. Fig. 2.

Fig. 1.—*Columnaria incerta.* End view of tubes.
2.— " " Side view.

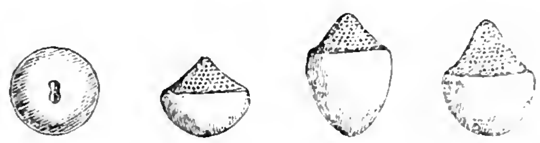
Description.—This species occurs in large globular or depressed hemispherical masses composed of long slender cylindrical tubes which are either in contact or separated less than their own width from each other. These tubes are upon an average half a line in diameter and when well preserved appear to consist of a simple wall without pores, radiating septa or transverse diaphragms. The aspect of the species is remarkably like that of a *Syringo-*

pora and in some of the specimens I think I can see some traces of connecting processes between the tubes, but the indications are not sufficiently distinct to be relied upon. The tubes are usually filled with white calcareous spar.

I strongly suspect that the tubes were during the period of their vitality filled with a delicate vesicular tissue similar to that of a *Syringopora* or *Cystiphyllum*, and should this structure be hereafter detected, the species must be either referred to *Syringopora* or a new genus must be formed for its reception. On the other hand, both transverse diaphragms and radiating septa may be discovered, in which case it must remain in the genus *Columnaria*.

Locality and formation.—Mingan Islands, Island of Montreal. and near the city of Ottawa. Chazy limestone.

Collectors.—Sir W. E. Logan, J. Richardson, and E. Billings.



Figs. 3, 4, 5, 6.

Figs. 3, 4, 5, 6.—*Bolboporites Americanus.* Fig. 3 represents the small pit in the base.

BOLBOPORITES AMERICANUS. (N.s.)

Description.—These curious little fossils consist of a smooth solid hemispherical base surmounted by a conical projection which is celluliferous, the cells being about the size and shape of those of the common *Stenopora fibrosa.* In the centre of the base there is a small pit which appears to have been the point of attachment. The solid part, under the hammer, usually breaks up into rhomboidal fragments, but some specimens when fractured exhibit a prismatic structure, the prisms radiating from the centre and being about the size of the tubes in the celluliferous conical extremity. It is remarkable that the cells slope downwards instead of upwards as in all other zoophytes, and it is possible that the apex of the cone is the base: the greater size and the solidity of hemispheric extremity, however, would seem to favour the opposite conclusion.

The specimens are from three to eight lines in length, and about the same in greatest diameter. The cone is usually of the same height as the hemisphere, but sometimes it is either shorter or longer.

Locality and formation.—Abundant in Chazy limestone in the neighbourhood of Montreal, and more rarely at the Mingan Islands.

CYSTIDEÆ. 7 Species.

The following species of *Cystideæ* from this formation were described in Canadian Fossils, decade 3. *Glyptocystites Forbesi; Malocystites Murchisoni; M. Barrandei; Palæocystites tenuiradiatus; P. Dawsoni; and P. Chapmani.*

Among the fossils collected at the Mingan Islands during the present year 1859, there are a few detached plates closely resembling those of *P. tenuiradiatus*, and others similar to those of *G. Forbesi*, but they are obscurely preserved, and better specimens must be procured before the species can be determined. Associated with these there is a single plate of a new species of *Palæocystites*, which I propose to describe as follows:

PALÆOCYSTITES PULCHER. (N. S.)

Description.—The only plate that I have seen is pentagonal and in form somewhat like a low five-sided pyramid. The sloping faces are striated by deep narrow sulci at right angles to the edge of the plate as in *P. tenuiradiatus.* The five sloping angular edges which radiate from the centre to the angles of the plate have each a single deep sulcus and this character is the only one by which this species can be distinguished in detached plates The sloping angles in *P. tenuiradiatus* are in all the specimens I have seen, solid, and exhibit no trace of a furrow. In this specimen, although the form is that of a low pyramid, yet the apex is truncated, with a small concave space in the centre around which the upper ends of the sloping angles form five small elevations. The sloping faces are also a little concave, but these characters may be the effect of weathering. Length of the sides of the plate, about three lines, with from fourteen to sixteen sulci to each face. It is most probable that in the perfect plates, all the sulci are covered over as they are in *P. tenuiradiatus.*

Locality and formation.—Mingan Islands. Chazy limestone.

Collectors.—Sir W. E. Logan. J. Richardson.

CRINOIDEÆ. 14 species.

Of the Chazy Crinoids, the following are described in Decade 4: *Blastoidocrinus carchariædens; Pachyocrinus crassibasalis; Hybocrinus pristinus; Palæocrinus striatus;* and *Rhodocrinus asperatus.* Besides these the columns of nine other distinct species are known to me in this formation.

BRACHIOPODA. 23 Species.

LINGULA LYELLI. (Billings.)

This species was published among the Calciferous Sandrock Fossils in the last number of the Canadian Naturalist and Geologist. At the time I prepared the article for the press, both Sir W. E. Logan and Mr. Richardson were absent. On their return, they informed me that upon stratigraphical evidence, they considered the conglomerate sandstones at the Allumette Rapids to be of the age of the Chazy. Afterwards, while examining a collection of Chazy fossils collected by Mr. Bell near L'Orignal during the present season, I found several specimens of *L. Lyelli* associated with abundance of *Rhynconella plena*, and also phosphatic nodules like those of the conglomerate sandstone. There can be no doubt but that the Allumette sandstone belongs to the Chazy formation. *Lingula Lyelli* must therefore be removed from the Calciferous fauna.

LINGULA BELLI. (N.s.)

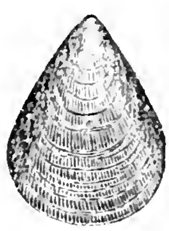


Fig. 7.

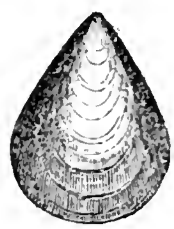


Fig. 8.

Fig. 7.—*Lingula Belli.* One of the forms of this species.
8 — " A convex form.
(In both figures the longitudinal lines represent shading.)

Description.—Oval, apical angle about 75°, lateral margins somewhat straight or gently convex for two thirds of the length, front angles and anterior margin broadly rounded, length one fourth or one third greater than the width; greatest width, at about one third the length or a little less from the front. Large specimens are one inch long and nine lines wide, but the usual size is one third smaller.

The form so far as regards convexity of the valves is somewhat variable. In general the specimens are strongly convex, or very obtusely carinate from the beak to near the centre of the shell, and have three flat slopes, one to each of the lateral margins and one to the front. The most prominent point is a little above the middle, and the anterior slope is always larger than the others. From this form, which is that of a very low three sided pyramid,

with all the angles and edges broadly rounded, there is a series becoming more and more convex, until all trace of the anterior slope is lost, while the two lateral slopes are only visible for a short distance below the beaks. By taking the extremes, several species might be made out of this one, but I am satisfied that they would not in the end be sustained.

The surface is sometimes nearly smooth, but usually it is marked by concentric undulations of growth. I have not been able to detect any minute concentric striæ between the larger undulations, and on only one of all the specimens that I have seen are there any longitudinal striæ, and these are only faintly indicated on the cast of the interior. The specimens collected in the Chazy limestone in the neighbourhood of Montreal are of a jet-black colour and often exhibit a polished shining surface, but those in the same rock in the valley of the Ottawa above Carillon, are light brown.

This species is closely allied to *L. antiqua*, (Hall) but is not longitudinally striated. In the Potsdam Sandstone on Lots 21 and 22, in the 9th concession of the Township of Bastard, *L. antiqua* occurs in vast abundance, and among the specimens collected at that locality, there are a great many which have almost exactly the same form as *L. Belli*, the only difference being the longitudinal striæ.

I have also before me specimens from the Falls of St. Croix, in Wisconsin, said to be the *L. prima* of the Potsdam, and these also have the depressed pyramidal elevation, but are in outline sub-orbicular or obscurely sub-pentagonal. The elongated form sometimes referred to *L. antiqua* appears to me be *L. acuminata*, (Conrad) and differs from all the above by being convex from the beak all along the median line to the front.

Dedicated to the late Rev. A. Bell of L'Orignal, an enthusiastic geologist, from whose labours the science in this Province has received much valuable aid. The beautiful collection of Canadian Fossils bequeathed by him to the University of Queen's College, Kingston, must always be of great service to the students of that excellent institution.

Locality and formation.—Island of Montreal ; near L'Orignal ; Allumette Island. Chazy. Perfect specimens rare.

Collectors.—Sir W. E. Logan, J. Richardson, R. Bell.

LINGULA HURONENSIS. (N. s.)

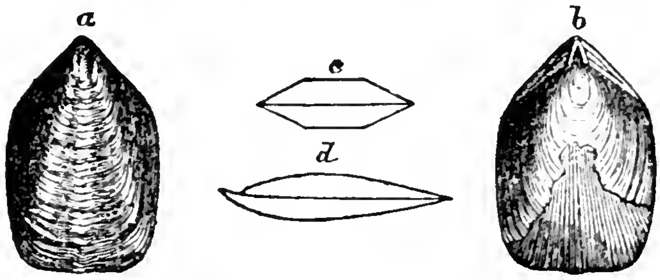


Fig. 9.

Fig. 9.—*Lingula Huronensis.* *a*, ventral valve; *b*, dorsal aspect, shewing the area of the ventral valve; *c*, transverse section; *d*, longitudinal section.

Description.—Sub-pentagonal, moderately convex, with three flat plane sloping faces as in *L. Lyelli.* Length nine lines, width six lines, dorsal valve half a line shorter than the ventral.

The beak of the ventral valve is obtusely pointed and the two posterior or upper margins diverge from it at an angle of about 70° and are straight or gently convex for a little more than one third the length of the shell, then turning an obtuse angle merge into the two lower lateral margins which are sub-parallel to the rounded front angles; anterior margin nearly straight.

Surface with concentric undulations of growth, and under the glass with minute concentric and longitudinal striæ.

This species approaches the *L. Davisii* (Mc Coy) of the Lingula Flags in Wales, but that species is a shorter and broader form, with an apical angle of from 95° to 100.° It is also closely allied to *L. attenuata*, (Sowerby) but according to the figures in *Siluria*, that species is smaller and more of an oval shape.

Each valve has three plane faces, the central one of which commences at the beak and gradually widens to the front. The other two slope to the lateral margins. In some specimens there is an obscure longitudinal ridge along the middle, running from the beak to the front. In a longitudinal section the valves are gently arched, the greatest convexity being nearer the beak than the front.

Locality and formation.—The most perfect specimens were collected on the island of St. Joseph in Lake Huron, in strata, which, from their holding *Columnaria alveolata*, I think must be regarded as of the age of the Black River Limestone. It also occurs near L'Orignal in the undoubted Chazy limestone, associated with *Rhynconella plena.* Professor Hind of Trinity College,

Toronto, has sent us a small slab from the Hudson River group, near Toronto, in which there are numerous impressions of this or a closely allied species.

Collectors.—A. Murray, J. Richardson, and R. Bell.

ORTHIS PERVETA (Conrad), ORTHIS SUBÆQUATA (Conrad), and ORTHIS GIBBOSA (Billings).

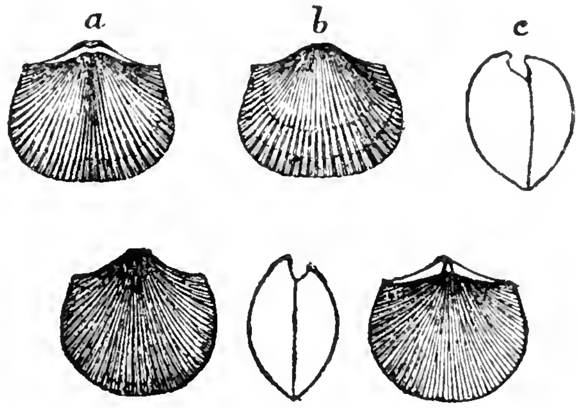


Fig. 10.

Fig. 10.—The above figures represent very nearly the species which I suppose to be *Orthis perveta*. *a*, *b*, and *c* are figures of a globose form, resembling some of the Tennessee specimens sent me by Prof. Safford, the director of the survey of that State.

In certain beds of the Chazy limestone there are multitudes of a small *Orthis* which have, as nearly as I can judge, precisely the form and dimensions of *O. perveta*, but, in consequence of their being imbedded in a rather compact sub crystalline rock, I have not been able to procure any specimens with the surface well preserved. Although it is impossible to determine the species with certainty, yet I firmly believe it will, when perfect specimens are procured, turn out to be the true *O. perveta*. It occurs in the Chazy limestone two miles north of Montreal, and I have seen it in vast abundance in a rock that crosses the road two or three miles west of the Village of Chazy, in the State of New York.

Of *O. subæquata* I have seen only a single specimen. It was found in an old quarry two miles north of Montreal.

O. gibbosa was described by me, in the Report for 1856, from specimens collected in the Black River limestone. It is distinguished from *O. subæquata* by having a broad, shallow, mesial sinus in the front half of the ventral valve. It varies greatly in the amount of the gibbosity and in the length of the hinge-line, which is sometimes only half the whole width of the shell. I am not yet satisfied that it should constitute a distinct species. Prof.

Safford, State Geologist of Tennessee, has sent me some very gibbous forms of *O. perveta*, and they very much resemble *O. gibbosa*. It may be that, by comparison with extensive series of western specimens, these three species might be united. I shall for the present keep them separate provisionally. *O. gibbosa* occurs rarely in the Chazy limestone, island of Montreal; abundantly, but badly preserved, at the Pallideau Islands, Lake Huron, in rocks which are either Chazy or Black River. At La Petite Chaudière rapids near Ottawa, and at the Fourth Chute of the Bonne-chère, in the Black River limestone, and in the Trenton limestone at Belleville. The other two species I have seen in the Chazy only, but in the Western States they are known in higher rocks.

ORTHIS IMPERATOR, (N. S.)

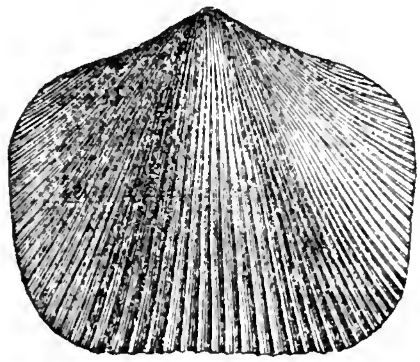


Fig. 11.

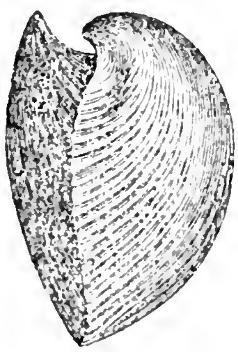


Fig. 12.

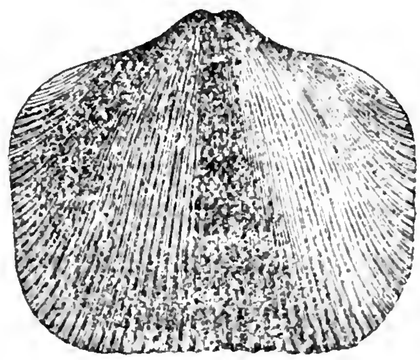


Fig. 13.

Description.—Subquadrate, large, very gibbous, hinge-line less than the greatest width of the shell; front margin gently convex, straight or slightly concave; front angles rounded; a portion of the sides, equal to about one third the length along the middle, usually straight, but sometimes a little convex, above which the sides curve inward to the cardinal angles.

The ventral valve is moderately and somewhat irregularly convex, the beak small, pointed, and much elevated. In most of the specimens a broad, low, mesial ridge or depressed fold extends

from the beak to the front margin; sometimes this fold is barely perceptible or obsolete, and in such cases the whole of the valve, except a small space at the cardinal angles, is flat, and slopes with scarcely any curvature from the beak to the front; at each of the cardinal angles a portion of the shell is depressed towards the dorsal valve. Area large, triangular, a little arched. Foramen not large, extending nearly to the apex of the beak.

Dorsal valve very convex, most elevated in the upper half, and sloping abruptly to the sides, front and cardinal angles, the latter strongly reflected, as is also in some specimens a narrow border along the upper one third of the sides; the beak and area strongly incurved over the hinge-line. Along the middle of this valve a broad, shallow, mesial furrow extends from the beak to the front. The foramen is occupied by a sharp cardinal process.

The surface is covered with moderately coarse, radiating ridges, about four or five in the width of two lines, at the margin. They appear to be two or three times subdivided between the beak and the front.

Width from one inch to one inch and a half; length about one sixth or one fifth less than the width.

This magnificent Orthis attains the size of the largest specimens of *O. occidentalis*, and somewhat resembles that species, but is always easily distinguished therefrom by the position of the mesial sinus, which occupies the dorsal valve instead of the ventral.

Locality and Formation.—Near Cornwall and in the township of East Hawkesbury. Large loose blocks of the rock several feet in diameter are occasionally met with, which are entirely composed of imperfect shells of this species, with only a small admixture of others. Judging from the appearance of these boulders, it must occur in vast abundance in the beds from which they were derived. It has been found in beds *in situ* only in Hawkesbury. Chazy limestone.

Collectors.—A. Murray, J. Richardson, R. Bell.

Orthis borealis, (N. s.)

Description.—Transversely broad oval or sub-quadrate; width usually one fifth or one fourth greater than the length; both valves more or less convex, sometimes very gibbous.

Ventral valve rather convex; greatest elevation at about one fifth or a little less from the beak, thence sloping somewhat abruptly to the cardinal angles and more gently to the sides and

front angles; the front margin more or less depressed by a broad' concave, mesial sinus of variable depth, which extends about half the length or a little more towards the beak, and there gradually disappears. Cardinal area large, slightly curved, and sloping upwards at an angle of 115° with the plane of the margin.

Dorsal valve convex, the amount of the convexity varying greatly; cardinal angles compressed and reflected. Area narrow, in the same plane with the margin; umbo in the very convex individuals large, and projecting beyond the hinge-line.

Surface covered with strong, rounded, radiating ridges, which in general extend without subdivision quite to the beak, those near the cardinal angles much smaller than those in the central and front region. There are four or five ridges in two lines at the front margin, and ten or twelve in the first two lines of the lateral margin, below the cardinal angles.

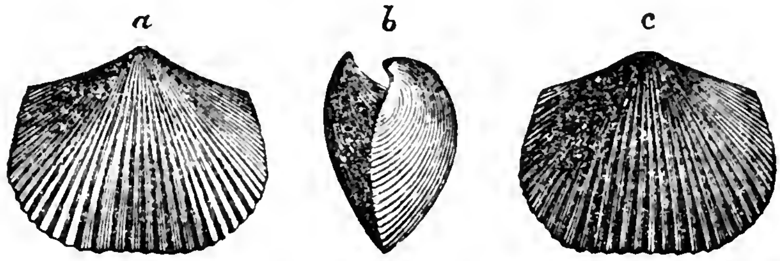


Fig. 14.

Fig. 14.—*Orthis borealis.* *a*, ventral aspect; *b*, side view; *c*, dorsal aspect.

Specimens of this species with the surface well preserved are difficult to procure, and I think it highly probable that in many the radiating ridges are subdivided or increase by implantation; but in the only perfect ones I have seen they are simple quite to the beak. In a specimen nine lines in width there are fifty-one ribs, including the finer ones at the cardinal angles, but the average number is between forty and fifty.

This species is somewhat variable in form. Some of the specimens are sub-quadrate, with the cardinal and front angles rounded, the sides being nearly straight, and in these the greatest width is usually near the front. Others have the sides convex, and these have the greatest width about the middle. Often the dorsal valve has an indistinct mesial fold extending from the beak to the front, while others have a slight depression, the effect of which, together with the depression in the ventral valve, is to produce a gentle sinuosity in the anterior margin. In general however, the dorsal valve has neither a mesial fold or sinus, but

is broadly convex, except near the beak, where it is narrowly gibbous and suddenly depressed, to the flat or concave space at the cardinal angles.

In many respects this species resembles *O. imperator*, but is never more than one-fourth the bulk of that species, and differs from it constantly by the sinus in the front half of the ventral valve. It also occurs in the greatest profusion in localities where the other is not found at all, while in other places the two are associated.

It is closely allied to *O. pectinella*, but is always much more convex and more numerously ribbed.

The width is usually nine lines, length about seven lines; depth of both valves in a very gibbous specimen, six lines.

Locality and Formation.—Caughnawaga; St. Genevieve; Isle Bizard; near the village of St. Laurent, and near Cornwall. At Caughnawaga it occurs in vast abundance, but rarely perfect. Chazy limestone.

We have several specimens from the Trenton limestone at Ottawa and Belleville which seem to be of this species.

Collectors.— Sir W. E. Logan, J. Richardson, E. Billings, R. Bell.

ORTHIS PLATYS, (N. s.)

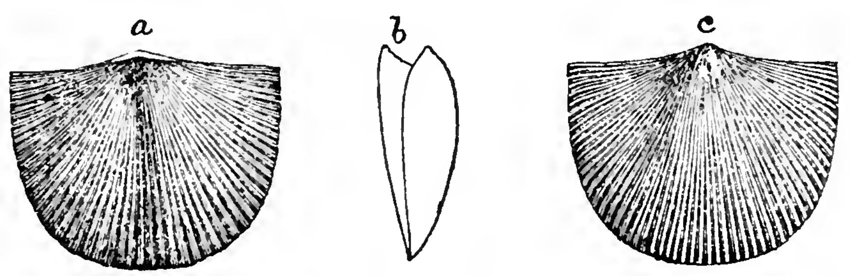


Fig. 15.

Fig. 15.—*Orthis platys.* *a*, dorsal aspect; *b*, longitudinal section; *c*, ventral valve.

Description.—Semi-oval, or sub-quadrate, both valves nearly flat; sides straight and sub-parallel for one half the length from the cardinal angles; front broadly rounded; hinge-line straight, equal to the greatest width of the shell; width one third greater than the length.

Ventral valve with the beak slightly elevated, depressed convex near the beak, gently concave all round near the margin; a broad, very shallow mesial depression extending from the front margin to about the centre of the shell; area moderate, forming an angle of about 115° with the plane of the margin; foramen triangular, extending to the beak, which is small-pointed and a very little depressed, not incurved at the point.

Dorsal valve gently convex, and with sometimes a barely perceptible mesial depression. Surface of both valves marked with fine radiating ridges, which bifurcate once or twice before reaching the margin ; from eight to ten ridges in two lines of the width of the front. Width about one inch ; length about nine lines.

This species somewhat resembles *O. subquadrata* (Hall), but is always flatter and more finely striated. It occurs in great abundance in the Chazy limestone, but is generally exfoliated, so that good specimens are rare.

Formation and Locality.—Chazy limestone, island of Montreal. Several specimens from Wolfe Island, near Kingston, appear to be referable to this species.

Collectors.—Sir W. E. Logan, J. Richardson, E. Billings.

ORTHIS PORCIA, (N. S.)

Figs. 16, 17, 18.

Figs. 16, 17, 18.—*Orthis Porcia.* Fig. 18 is a portion of the surface enlarged to shew the concentric imbricating striae.

Description.—Ventral valve conical, semi-oval ; width a little greater than the length ; hinge-line about equal to the width of the shell ; area large, much elevated, at right angles to the plaue of the margin, very slightly curved, beak erect and pointed ; foramen narrow, extending to the beak ; surface with thirty sharp elevated radiating ridges, with shorter ones between each two at the margin, crossed by fine, strongly imbricated concentric striæ which, although fine, give the surface a rugose appearance, Width four lines ; length three lines ; height of area from hinge-line to beak one line and a half ; width of foramen at hinge-line half a line. Dorsal valve unknown.

Only a single valve of this beautiful little Orthis has been collected, and I am inclined to think therefore that it must be an exceedingly rare species. The form and size are very nearly those of *O. disparalis*, but it differs from that species in having the radiating ridges not so strong and in the more perependicular area and imbricating concentric striæ.

Locality and Formation.—Two miles north of city of Montreal. Chazy limestone.

Collector.—E. Billings.

Orthis acuminata, (N. s.)

Fig. 19.

Description.—Of this species a single specimen only (a ventral valve,) has been found, but in good preservation. The hinge-line is much longer than the width of the shell, being produced so as to form extended ears, like those of many of the spirifers; the sides converge from the ears to the front angles; the front margin is nearly straight and parallel with the hinge-line, excluding the ears; the form is depressed conical, with a scarcely perceptible mesial sinus; the beak gently depressed, but not incurved; area large, and slightly curved; foramen very broad, open triangular, reaching to the beak. Surface covered with fine angular striæ, about six in one line at the margin; they appear to bifurcate near the beak. Length of hinge-line six lines; length of ventral valve from beak to front, two and a half lines.

This remarkable form differs from all the Orthides of the Silurian rocks of Canada except *O. Lynx*, some varieties of which have long acuminate ears. I am not satisfied that it is a true *Orthis*.

Locality and Formation.—Caughnawaga; Chazy.

Collector.—E. Billings.

Orthis disparalis. (Conrad.)

Orthis Disparalis. (Conrad) 1843, *Proc. Acad. Nat. Sci. Philadelphia.* Vol. 1, p. 333.
——————(Hall) 1847, *Palæont. N. Y.*, Vol. 1, p. 119, *plate* 32, Figs. 4. *a. b. c.*
Orthis Costalis ? (Hall) 1847, *Palæont. N. Y.*, Vol. 1, *plate* 4, (bis) Figs. 4. *a. b.*

Fig. 20.

Fig. 20.—*Orthis disparalis.*

Description.—Semi-oval, the ventral valve depressed conical, and the dorsal valve nearly flat. Surface with about twenty-eight

rounded undivided ribs. Width at the hinge line a little greater than the length.

The ventral valve of this species is strongly elevated with a large area inclining upwards at an angle of a little more than 100,° and slightly arched. From the pointed beak the outline makes a nearly regular curve to the front. Some of the specimens have along the middle, from the beak to the front, a broad carination on each side of which the surface slopes with a gentle or flattened curve to the lateral margins; others are uniformly convex. The area is large, triangular, and with a very narrow foramen which extends quite to the beak.

Dorsal valve nearly flat, a shallow mesial depression along the middle from the beak to the front. On each side of this depression there is a very slight convexity, and then a flat slope to each of the cardinal angles. The area is narrow and sloping upwards and outwards at an angle of a little more than 100° with the plane of the lateral margin. It is divided in the middle by a small triangular foramen.

Width at hinge line four lines; length of dorsal valve three lines; length of ventral valve from beak to front, three and a half lines; height of area of ventral valve one line and one third.

The specimen from which the above description is drawn is the only one, except those procured at the Mingan Islands, that I have ever seen in the Chazy limestone. In its form and dimensions it agrees so nearly with the descriptions of Conrad and Hall, and with the figures in the Palæontology of New York, that there can be scarcely any doubt of its being the same species.

At the Mingan Islands a number of good specimens of an *Orthis* have been collected which are precisely the same as the one above described in every particular, except that they are upon an average two thirds larger, and in some of them the beak is not proportionately so much elevated. In others the beak is quite as prominent as it is in the Montreal specimen, and I do not think it possible, therefore, that they can constitute a distinct species.

Orthis costalis (Hall) has never been sufficiently described and illustrated to enable us to recognize it with certainty. It is said to have a flat dorsal valve and about 32 ribs, but the figures shew from about 32 to less than 20. It may be that when better specimens are procured, it will appear that *O. costalis* and *O. disparalis* are the same.

On comparing the Mingan Island specimens with small individuals of *O. tricenaria*, I find that the hinge line of the latter is proportionally a little shorter, while the dorsal valve has a scarcely perceptible concavity. Large specimens of *O. tricenaria* are one inch wide at the hinge line, but the more common width is nine lines. In the large individuals the beak is proportionally more depressed than it is in the small ones.

Locality and formation.—One specimen two miles north of Montreal. More common at the Mingan Islands. Chazy limestone.

Collectors.—Sir W. E. Logan, J. Richardson, E. Billings.

Orthis piger. (N. s.)

Description.—Transversely semi-oval or sub-quadrate, hinge line equal to the greatest width of the shell or nearly so; lateral margins sub-parallel, straight or gently convex for a little more than half the length from the cardinal angles; front angles rounded, anterior margin straight or gently convex for half the width. Length one fifth to one fourth less than the width.

Ventral valve depressed conical, gently curved from the beak for one fourth the length, then descending with a somewhat flat slope to the anterior margin and cardinal angles. The beak in the small specimens is the most elevated point, but in the larger, the most prominent region is a little in front of the beak. Area large, triangular, and gently arched upwards and outwards at an angle of about 110° with the plane of the lateral margins. Foramen not observed.

Dorsal valve strongly and uniformly convex, with a moderate compression at the cardinal angles; area narrow, beak not very strongly incurved.

Surface with fine undivided radiating ridges of which there are three in one line at the middle of the front margin in a specimen seven lines wide, and four in a specimen five lines wide. These ridges are crossed by fine closely arranged imbricating concentric striæ.

Width of largest specimen seen, (a ventral valve) seven lines, length from beak to middle of front margin six lines; from hinge line to front margin five lines; height of area two lines; length of hinge line six and a half lines; greatest width at about one third the length from the front.

Width of small specimen five lines; length of dorsal valve four lines; height of area of ventral valve one line and a half; depth of both valves three lines.

In two of the specimens there is evidence of a very slight mesial sinus along the middle of the dorsal valve.

Closely allied to *O. grandæva* of the calciferous sandrock, but differs therefrom by being more closely ribbed. Should it, however, turn out that this species has a closed foramen, it may perhaps be united with *O. grandæva.*

Locality and formation.—Mingan Islands. Chazy limestone.

Collectors.—Sir W. E. Logan. J. Richardson.

Genus Strophomena.

Fossils of this genus have as yet been only rarely seen in the Chazy limestone in Canada and such as we have collected are with the exception of some half dozen specimons, in a very bad state of preservation. I think, however, that I can recognize the following:—

Strophomena incrassata. (Hall)—This shell in external form exactly resembles some of the smaller varieties of *S. alternata,* but, in the interior of the dorsal valve the muscular impressions are divided by two or three rather strong elevated ridges on each side, a character which appears to show that it is a distinct species. It occurs in the Chazy limestone at the Mingan Islands, and in the Black River limestone at the Fourth Chute of the Bonnechére. Specimens from the latter locality agree precisely with those sent me from Tennessee by Prof. Safford. The specimens from Mingan are a little more convex.

Stophomena alternata. (Conrad)—Occurs at Mingan, and I think near Montreal also in the Chazy.

There are two other species, one of which is resupinate like *S. planumbona,* but more specimens are required before they can be determined.

Rhynconella orientalis. (N.s.)

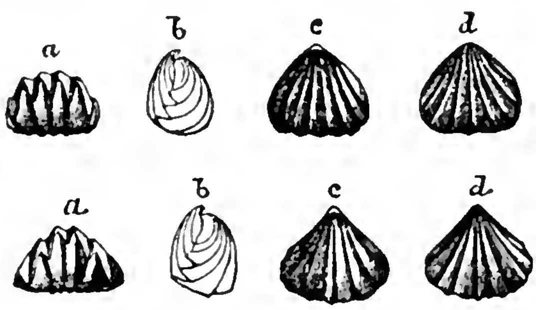


Fig. 21.

Fig. 21.—The above figures represent the different views of two specimens of *R. orientalis.*

Description.—Triangular, varying from moderately convex to sub-globular, apical angle from 80° to 100°; sides straight or nearly so for about two-thirds the length; greatest width at one-fourth or one third from front; front angles truncated; front straight or rounded. The ventral valve in the upper half is narrow or somewhat acute, with the beak in the more slender individuals prominent, and moderately arched, but in the globose forms incurved down to the umbo of the dorsal valve; in the front half strongly elevated at the angles on each side of the sinus; the latter is deep in front, but dies out at a little more than half the length. Dorsal valve the most convex; beak closely incurved; the umbo rather broad, rounded, divided into lobes by a narrow sulcus which extends from the beak one-fourth or little more of the length downwards, a strongly elevated mesial fold extending a little more than half the length. Surface with about nine acutely angular, strongly elevated ribs, of which there are usually three in the sinus and four in the mesial fold. The upper half of the shell is compressed laterally, so that just below the beak on each side there is a flat or concave oval space, which is smooth in the centre, but sometimes exhibits two or three small ribs on each valve. I have not detected any concentric striæ. Length three or four lines; width, either equal to or a little greater than the length.

This little shell is quite distinct from *R. plena*, differing therefrom in its smaller size and proportionally larger ribs. *R. plena* has from 15 to 20 ribs; bnt this species has only 9 or 10, excluding the small and short ones on the sides. It is found in great abundance in certain beds of the Chazy limestone at the Mingan Islands. I have seen no specimens of *R. plena* from that locality, and this species appears to be its representative there.

Locality and Formation.—Mingan Islands. Chazy Limestone.

Collectors.—Sir W. E. Logan and J. Richardson.

RHYNCONELLA PLENA. (Hall, S.p.)

ATRYPA PLENA, A. ALTILIS, A. PLICIFERA (Hall), Palæont., N. Y. *Vol.* 1, p. 21, 22, 23. Plate 4 bis.

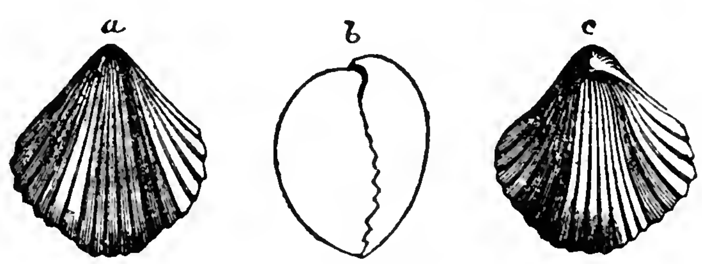


Fig. 22.

Fig. 22.—A large specimen of *R. plena*. Those that are found in such great numbers at Montreal are in general smaller than the above.

This species occurs in vast numbers in the Chazy Limestone, on the Island of Montreal, near Cornwall, and at many localities in the valley of the Ottawa. It varies in form and in the number of ribs in the mesial sinus and on the mesial fold. No sufficient distinction has been shewn between the three species above cited.

Camerella longirostra. (Billings.)

Camerella longirostra (Billings), Canadian Naturalist and Geologist. Vol. 4, p. 302.

Fig. 23.

Fig. 23.—*Camerella longirostra.* The specimen has the beak of the ventral valve covered by a small fragment of stone, which cannot be removed.

This species occurs at the Mingan Islands in the Chazy Limestone.

Camerella varians. (N.s.)

Fig. 24.

Fig. 24.—Different views of two specimens of *Camerella varians.*

Description.—Sub-triangular; apical angle varying from 75° to 100°; valves moderately and nearly equally convex; the ventral valve with a wide moderately deep sinus, which becomes obsolete at less than half the length; dorsal valve with a corresponding fold; sides straight from the beak for one-half or two-thirds the length; front angles rounded; front margin straight or gently convex; two to four short rounded ribs in the sinus and one or two on each side; three to five on the mesial fold and one or two on each side. These ribs become absolete at about one-third or one-half the length, and all the upper part of the fossil is smooth; beaks small sub-equal; that of the ventral valve a little more prominent than the other, and with apparently a small triangular foramen beneath it. Beak of dorsal valve incurved; Length four

or five lines; the greatest width is at about one-third or one-fourth the length from the front, and is either equal to or a little less than the length.

This species resembles *Camerella hemiplicatus* (Hall, S.p.); but is always smaller and not so globose.

Locality and Formation.—Mingan Islands. Chazy Limestone.

Collectors.—Sir W. E. Logan and J. Richardson.

BRYOZOA. 5 species.

Three of the species appear to belong to *Fenestella* or *Polypora;* the others to *Ptylodictya*. They require further examination and comparison before they can be described.

LAMELLIBRANCHIATA. 17 Species.

These fossils are rare in the Chazy limestone, yet the species appear to be somewhat numerous. I think I can make out 17 species belonging to *Ctenodonta*, *Cyrtodonta*, *Vanuxemia*, *Modiolopsis*, and probably two or three other genera.

As the specimens consist mostly of casts, they must remain undescribed until better can be procured. The following are all that I have determined up to the present date:—

CTENODONTA NASUTA. (Hall, S.p.)

Tellinomya nasuta. (Hall.) *Ctenodonta nasuta*. (Salter.)

This well known species occurs in the Chazy sandstone at Lac Aurau River above the River Rouge and also at the Mingan Islands in the Chazy limestone.

MODIOLOPSIS PARVIUSCULA. (N.s.)

This species closely resembles *M. modiolaris* (Conrad); but is always less than half the size of that species. It occurs in the Chazy limestone at Montreal, near Cornwall, at the Mingan Islands, on the Islands at Lake Huron, and also at Punk Island, Lake Winnipeg.

CYRTODONTA BREVIUSCULA. (N.s.)

Description.—Sub-rhomboidal; hinge line straight elevated; anterior extremity broadly rounded; posterior extremity obliquely truncated and somewhat straight from the hinge line to within one-third the height from the posterior ventral angle, which is rather narrowly rounded; ventral margin gently concave about the middle; umbones small, obtuse, near the anterior extremity; valves rather strongly convex, most prominent about the middle;

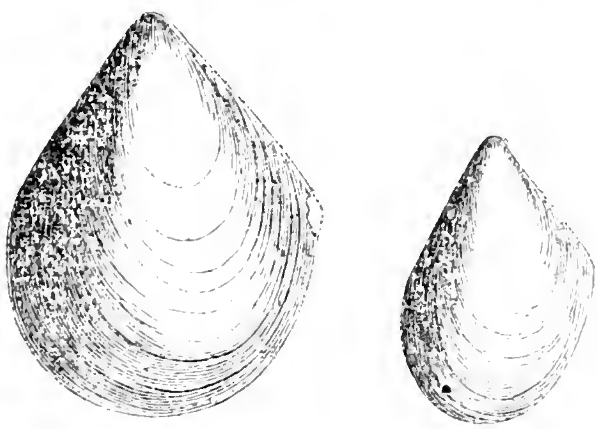
thence sloping abruptly to the hinge line and posterior and ventral margins.

Length from posterior ventral angle to anterior extremity six lines; height from ventral margin to posterior extremity of hinge line four lines; from beaks to ventral margin three lines; beaks within one line of most projecting point of anterior extremity; surface apparently concentrically striated.

Locality and Formation.—Chazy saudstone, three miles east of the city of Ottawa, half a mile back from the river.

Collector.—E. Billings.

VANUXEMIA MONTREALENSIS. (N. s.)



Figs. 25, 26.

Figs. 25, 26.—*Vanuxemia Montrealensis.*

Description. — Obliquely sub-oval or sub-rhomboidal, with an indication of a posterior wing; surface with fine concentric striæ; length about an inch and a-half.

The beaks are small, pointed closely, incurved and directed forwards; the umbo is rather strongly elevated and narrowly rounded; from the umbo the convexity of the valve gradually increases in width, is most prominent about the centre or a little nearer the beak than the centre and from that point diminishes in all directions towards the posterior and ventral margins. The anterior margin near the beak has not been observed; but, judging from the cast, it does not appear to be alated. From the beak it inclines backward at an angle of about 75° with the hinge line for three-fourths the whole length when it gradually curves to produce the broadly rounded postero-ventral extremity. The hinge line is straight, and its length appears to be about equal to three-fourths of the diagonal of the shell from the beak to the lower posterior angle. The posterior extremity of the hinge line has not been observed; but it probably forms an obtuse angle

with the posterior margin, while the latter is only gently convex until within one-third of the base, then rounded to the lower margin. The wing is rather prominent and scarcely at all compressed.

Diagonal of the largest specimen fifteen lines.

A specimen of this species without the wing is rather acutely oval, and has an aspect very different from the perfect form.

I have placed it in the genus *Vanuxemia* provisionally, but it may be necessary hereafter to remove it to some other genus.

Locality and Formation.—Island of Montreal and near L'Orignal. Chazy Limestone. Not common.

Collectors.—Sir W. E. Logan and R. Bell.

GASTEROPODA, 21 species.

There are in the Lower and Middle Silurian rocks of Canada upwards of thirty species of Gasteropoda that must be distributed among the genera *Pleurotomaria Scalites* and *Raphistoma*, provided these groups be retained as distinct from each other. But after giving the subject a great deal of consideration, I cannot see that the last two are possessed of any structural peculiarity of sufficient importance to warrant a separation from the first. It has always been supposed that *Scalites* and *Raphistoma* were destitute of a spiral band, yet the species which I have called *P. docens* has a band as strongly marked as it is in any known species of *Pleurotomaria*, while it has also a nearly flat spire, a largely developed conical base, and no umbilicus. The three latter characters, combined with the peculiar aspect of the shell, shew that we cannot separate it generically from *Scalites*, and yet the spiral band connects it with *Pleurotomaria*. This fossil had not been discovered at the time of the publication of Decade I., otherwise a view of the affinities of *Scalites* different from that put forth in the work would have been maintained.

In general the fossils of this group are not well preserved in our rocks; but in the large collections of the Geological Survey there are specimens of many species retaining the surface markings, and it is quite clear that all have either a spiral band, or a sharp bend in the lines of growth which is equivalent thereto. In connection with the band there is also in all the species a notch in the outer lip, and there cannot be the least doubt but that the band was formed by the progressive filling up of the notch during the growth of the shell, precisely as in the genus *Pleurotomaria*.

In some of these forms which have a very sharp outer angle, the band is situated exactly on the edge of the whorl, and it is then smooth in all the species in which I have been able to see it distinctly. In *P. calyx* it is double, or composed of a minute flat smooth band on the upper surface sloping downwards to the edge, and a similar one below sloping upwards, the two consituting what may be called a bevelled edge to the whorl. In none have I seen the striæ passing over the edge of the whorl; but it is evident that as they curve backwards both on the upper and under sides on approaching the edge, they must either pass over it or not; and in the latter case the band must be smooth, while in the former it must consist of a simple angular bend in the lines of growth. In several (and among these *P. docens*) the band is altogether on the upper surface, but close to the outer edge. Of *Scalites angulatus* we have no specimens, but, according to Professor Hall's description, the surface is, on the "upper side of the whorls, marked by striæ directed obliquely backwards, and which, on passing over the angle, are directed somewhat spirally forwards."* As these striæ indicate the form of the aperture, there must be a notch in the lip of *S. angulatus*, with the deepest point exactly at the angle of the whorl, and also an angular bend in the lines of growth equivalent to a band. So far, then, as the presence or absence of a band and notch can affect the question, there is no generic difference between *Scalites* and *Pleurotomaria*, and if the two genera are to be maintained as distinct, it must be upon some other characters not yet pointed out.

It might be thought that the difference between the forms of the Lower Silurian species and those of the more recent rocks would be sufficient to warrant their separation into two or more genera. But upon examination it will be seen that *Pleurotomaria* consists of more than 400 species, varying from pyramidal forms, or those with an elevated and pointed spire and flat base, through those that are nearly globose or with the base as greatly produced as the spire, to such as *P. docens*, with the spire nearly flat and the base conical. *P. Ramsayi*, which has a flat or slightly concave base, represents the pyramidal form in our rocks, and *P. docens* the opposite extreme. *P. Ramsayi* is all spire and no base, while *P. docens* is all base and no spire. If a plane

* Palæont. N. Y., Vol. I. p. 27.

be projected through the outer angles of these two species, it will be seen that in one the animal must have lived nearly altogether below this plane, and in the other nearly altogether above it. There are numerous species with about half the bulk of the shell above and half below, and others with every intermediate proportion.

Notwithstanding the great number of species in this genus, all attempts at a subdivision have hitherto failed. A number of small groups of species having some peculiarity in common might be pointed out, but these would not differ from each other generically. For convenience in classification, De Koninck makes two large groups.

1.—The ORNATÆ, with angular whorls and the surface richly ornamented with ridges and tubercles.

2. The GLOBOSÆ, of which the form is more or less globular, and the surface not at all or only moderately ornamented.

This last group is divided by D'Orbigny into the PERSPECTIVÆ, with the umbilicus so wide that all the whorls can be seen in it, and the FALCATÆ, with the umbilicus very small or altogether closed.*

Scalites is not a genus, but rather a small group of species distinguished by having the outer edge of the whorls angular, the upper surface sometimes flat and at right angles to the longitudinal axis of the shell, the spire sometimes elevated and consisting as it were of a series of rectangular steps and the umbilicus sometimes closed. The extreme form of the group is *S. angulatus*, which, by its elevated spire, indicates an approach to the genus *Murchisonia*.

The genus *Raphistoma* was originally founded upon three species of *Scalites*, and appears to have been designed to take the place of that genus, for we find that, in his generic description, Professor Hall has the following remark: "It is probable also that the generic characters here given may be so extended as to include the *Scalites* figured above, as I have some evidence of the existence of the characteristic markings upon that shell." Palæont. N. Y., Vol. I., p. 28. The following are the views of other authors upon the affinities of *Scalites*, so far as I can ascertain.

* See L. DE KONINCK, Description des Animaux Fossiles qui se trouvent dans le terrain carbonifere de Belgique, Vol. I. p. 364. Also ALCIDE D'ORBIGNY, Paleontologie Française, Terrains Crétacés, Vol. II. p. 239.

De Orbigny.—This author thinks *Scalites* allied to *Straparollus*, and only differing therefrom by having the umbilicus closed. He quotes *Raphistoma* as a synonym.*

Pictet places *Scalites* among the *Trochidæ*, and thinks that if *Raphistoma* is to be retained it must be differently defined.†

F. Roemer refers *Scalites* to the genus *Euomphalus*, and says that *Raphistoma* differs from *Scalites* only in having the spire more depressed.‡

S. P. Woodward makes of *Scalites* a sub-genus of *Pleurotomaria*. He cites *Raphistoma* as a synonim.§

Salter has given to *Scalites* the rank of a genus, and he makes *Raphistoma* a sub genus, which would include all such species as *P. qualteriatus*, *P. lenticularis*, &c., &c.‖

It must be observed that in forming their respective opinions, the above-named eminent Naturalists and Palæontologists had not before them specimens such as *P. docens*, exhibiting a well-defined spiral band.

Our collections confirm the opinion of Mr. Woodward, but I do not think it convenient to retain *Scalites* even as a sub-genus; because, as I shall shew hereafter in another publication, the transition from *Scalites angulatus* to such forms as *P. rotuloides* (Hall) is so gradual, through a perfect series of species, that, to determine whether certain forms should be placed in the genus or sub-genus, will be next to impossible, and occasion an useless expenditure of time and mental labour. When the lines between groups become so excessively inconvenient, they should be blotted out altogether. For the present, therefore, I shall place all our species in the genus *Pleurotomaria*. Judging from the number of species in the Canadian rocks, I think there must be a great many others in the extensive private or public collections of Lower Silurian fossils in the Western and Southern States; and until all these are described and figured we cannot have all the facts before us upon which the classification must be ultimately founded.

On examining the numerous species of *Euomphalus* or *Schizostoma*, figured and described in the works of Goldfuss, De Koninck,

* Prodrome de Paléontologie. Vol. 1, p. 7.

† Traite de Paléontologie. Vol. 3, p. 153.

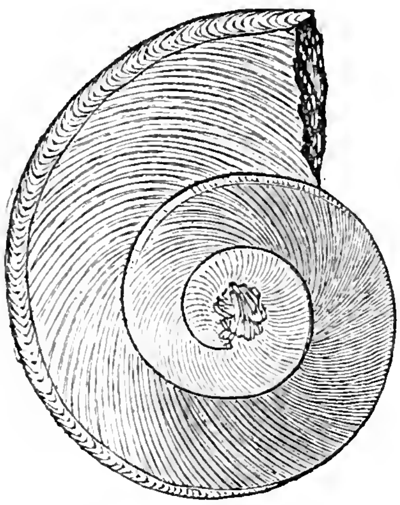
‡ Bronn's Lethaca Geognostica. Vol. 1, 456.

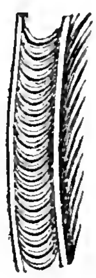
§ Woodward's Recent and Fossil Shales, p. 147.

‖ Salter, Canadian Fossils, Decade 1, p. 10.

De Orbigny, and others, lc will be seen that some, such as *Schizostoma delphinuloides*, *S. fasciatum*, *S. taeniatum*, *S. vittatum*, *S. costatum*, *Euomphalus*, *Dionysii*, *E. catillus*, and other allied forms, have a spiral band, with backward curving lines of growth, differing only from *Pleurotomaria* in their more slender cylindrical whorls and wide umbilicus. Many of these, although perhaps generically distinct, should, I think, at least be placed in the same family with *Pleurotomaria*.

PLEUROTOMARIA DOCENS, N. S.





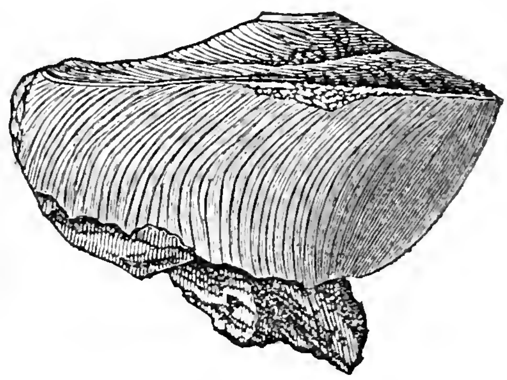


Fig. 27. Fig. 28. Fig. 29.

Fig. 27.—*Pleurotomaria docens.* View of the spire of a specimen from the Chazy Limestone near L'Orignal. On one side the band is partly worn away or concealed.

28.—A portion of the band a little enlarged.

29.—Side view of same specimen; the lower part of the base broken away.

Description.—Spire nearly flat; base sub-hemispherical; umbilicus closed; whorls about four, with a distinct spiral band all round on the outer margin; width, usually a little more than an inch and a half; height, about two-thirds the width.

On the upper side the whorls in the centre are gently convex and elevated, so that the apex is about three lines higher than the outer margin. As the whorls enlarge they gradually lose the slight convexity which they possess at the centre, and become more and more flattened, until at the aperture the last is either quite flat or even a little concave. The first whorl is very small, but the others somewhat rapidly enlarge so that at the aperture the last one is full six lines wide, where the whole width is eighteen lines.

The band forms the outer margin of the upper surface. At the aperture it is one line wide, but it becomes gradually smaller, and at the apex is reduced to a mere line. It is crossed by strong backward curving striæ, and has a fine elevated line-like ridge on each side.

On the lower side the whorls are ventricose, and constitute a sub-hemispherical or depressed conical base. At the aperture the outer lip is at right angles to the upper lip or upper surface of the whorl; but this angle decreases as we follow the margin of the whorl backwards towards the apex, at such a rate, that, at the commencement of the last wherl, it is not more than 75°.

In no specimen that I have seen is the aperture perfect; but, judging from the evidence of numerous fragments, the upper lip is straight and at right angles to the longitudinal axis of the shells. The outer lip in its upper half is at right angles to the upper lip, or very nearly so; but in its lower half it curves inward to the closed umbilicus. The inner side is gently concave, or nearly straight. The height of the aperture, as exhibited in the fracture across the last whorl in the specimen figured, is eight lines, and its width at the upper lip nearly six lines.

The surface is covered with coarse, but only slightly elevated, undulations of growth, the width of which is from one-sixth to half a line. Besides these it is striated with fine lines of growth, of which there are about ten or twelve in the width of one line. On the upper surface the striæ and undulations turn backwards at an acute angle from the inner to the outer edge of the whorl. On the lower surface they curve forward and then backwards.

The shell in the spire is thin, but below very thick. When the shell has been totally destroyed, the cast of the interior exhibits an umbilicus one-eighth of the whole width of the spire.

We are not yet in possession of a sufficient number of specimens to enable us to point out how far this species may vary from the description above given. It is probable that the principal variations will be in the height in proportion to the width. We know that other species of this group, such as *P. Laurentina* and *P. calcifera*, are variable in this respect; and we have some specimens, which, although their height is only half the width instead of two-thirds, I think should be referred to this species; but, of course, such a reference cannot be confirmed until individuals with the surface-markings preserved shall have been procured. Some of the specimens are two inches and a half wide.

Locality and Formation.—Near L'Orignal. Chazy Limestone. *Collector.*—R. Bell.

PLEUROTOMARIA IMMATURA, N. S.

Description.—Spire nearly flat, the apex elevated four or five lines above the margin in specimens one inch and a half wide, the last whorl depressed one and a half lines below the preceding; base depressed sub-hemispheric or conical; whorls, four or five, with a narrowly-rounded outer edge; width, from one inch to one inch and a half; height, a little more than half the width.

The band in this species is apparently smooth, and placed precisely on the outer margin of the whorl, where it forms a rounded edge nearly a line in thickness, just above and below which the whorl is suddenly a little concave. The apex is not acute but rounded, and the suture for the first two or three whorls is not distinct, but afterwards becomes more apparent as the succeeding whorls become depressed. Owing to the depression of the outer whorl the spire is semi-turretted, the outer margin of the penultimate whorl forming a step-like elevation above the inner margin of the last. The surface is marked by rather fine backward curving striæ, and narrow irregular undulations of growth. The upper surface of the first and second whorls forming the rounded apex of the spire are gently convex, but the outer ones are flat, or a little concave.

I have seen no specimens of this species with the base well exposed, but the rounded edges of the whorls and semi-turretted spire are characters sufficient to distinguish it from any other Chazy species. From what I have seen, I think the umbilicus must be either very small or entirely closed.

The proportional width of the whorls is variable. In one specimen thirteen lines wide the outer whorl has a breadth on its upper flat surface of three lines, which is also its width in another individual with a spire sixteen lines wide.

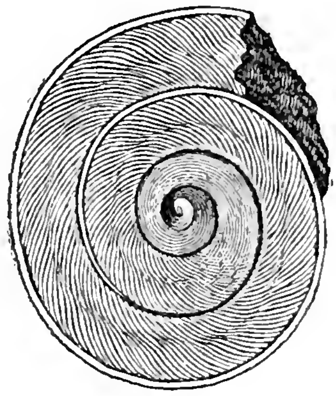
Locality and Formation.—Two miles north of Montreal. Chazy Limestone.

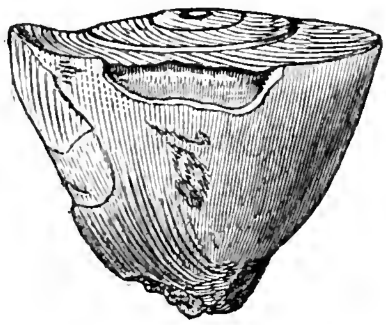
Collector—E. Billings.

PLEUROTOMARIA CALYX, N. S.

Description.—Spire nearly flat, with an acute or sharply-rounded outer margin; base conical, more or less produced below;

whorls, including a minute one in the apex, five; height, from one-half to four-fifths the width; no umbilicus.





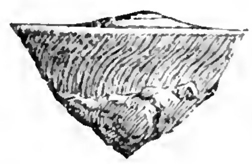


Fig. 30, 31, 32.

Fig. 30.—View of the spire of *P. calyx.*
31.—Side view of same specimen.
32.—Side view of a small specimen.

On the upper surface the first two or three whorls are gently convex or flat, and constitute a small elevation in the centre of the disc from half a line to two lines higher than the margin. The outer whorls are flat or gently concave, and the last one is in some individuals depressed a little below the margin of the next preceding. Just beneath the margin there is usually (not always) a shallow wide concave band, and below this the whorls are produced downwards with a gentle tapering convex slope, so as to form a conical base which is more or less acute. In some specimens the base is nearly hemispheric, its length being half the width of the spire; but in others it is more conical; and in the one represented by Fig. 31, the length is full four-fifths the whole width. In small specimens consisting of three or four whorls, the outer edge is exceedingly acute, and is bevelled, as it were, by two very narrow flat bands, one above and the other below. In large specimens the edge becomes a little more obtuse towards the aperture, and the small flat bands disappear.

The upper surface is marked by fine striæ and numerous small furrows or undulations of growth, the whole curving backward at an acute angle with the suture. The markings are interrupted or undulated about the middle of the whorl, so that in crossing the surface from the inner to the outer edge they make two obscurely sigmoid curves. Below the margin the surface is ornamented with similar striæ, which, in descending, curve forwards and then backwards. In most of the specimens they are undulated below as well as above the margin.

The specimens are from three to fourteen lines in width, and the length varies from a little more than one-half to four-fifths of the whole width. The variation in the proportional length and width is partly owing to differences in the thickness of the shell. Some have the shell so greatly thickened below that one or two lines is added to the length thereby. It is well known that many of the mollusca of the existing seas are subject to great variations in the thickness of the shell.

This species closely resembles the *Raphistoma staminea* (Hall); but as Professor Hall says in his description of the genus (Palæontology of New York, vol. 1, page 28) that the umbilicus is "moderately large," I infer that the three species described by him must be umbilicated. In page 29, he states that "the striæ (on the surface of *R. staminea*) bend abruptly forwards, and, curving gently round, pass into the umbilicus"; from which expression no other conclusion can be drawn than that *R. staminea* does possess an umbilicus. Our species is not umbilicated; and, therefore, I believe it to be distinct from *R. staminea.*

Locality and Formation.—Island of Montreal. Chazy Limestone.

Collectors—Sir W. E. Logan, J. Richardson.

PLEUROTOMARIA CREVIERI, N. S.

Figs. 33, 34, 35.

Fig. 33.—Side view of *Pleurotomaria Crevieri.*
34.—View of spie.
35.—Side view of a different specimen.

Description.—Shell small; whorls four; spire nearly flat; base sub-hemispherical; no umbilicus.

On the upper surface the first two whorls form a low, rounded elevation in the centre, rising a little above the outer margin; the others are gently concave, and a little depressed below the margin of those preceding. The base is sub-hemispherical or depressed conical, the length a little more than half the width of the spire. The surface is marked with fine striæ of unequal size, curved as in all the other species of this group. The outer margin is acutely rounded, not bevelled as it is in specimens of *P. calyx*, of the same size. Width of spire, five or six lines.

Dedicated to Dr. J. A. Crevier of St. Hyacinth, whose zeal in the science of geology promises to be productive of important results.

Locality and Formation—St. Dominique, Chazy Limestone.

Collectors.—Sir W. E. Logan, Dr. Crevier.

PLEUROTOMARIA PAUPER, N. s.

Description.—Shell small; whorls three or four, flat above, ventricose below, and obtusely angulated at the edge of the umbilicus; width, from four to eight lines; height, half of the length.

The spire is perfectly flat, and the outer margin in the cast acutely rounded. Below the margin the base tapers, with a gentle convexity, to the edge of the umbilicus. In a specimen five lines wide, the last whorl has a width of two lines on the upper surface at the aperture, the depth from the upper side to the lower angle of the aperture being also two lines, and the umbilicus one and a half lines wide. In the cast of the interior, the suture is deep, rounded at the edges, and the upper side of the whorls gently convex. Surface unknown.

About the size and shape of *P. Crevieri*, but with a perfectly flat spire and an umbilicus.

Locality and Formation.—Grenville. Chazy.

Collector—Sir W. E. Logan.

Besides the above there are six other species of *Pleurotomaria* in the Chazy, but they must remain until better specimens can be procured.

MURCHISONIA INFREQUENS, N. s.

Description.—Elongate, slender apical, angle about 20°; whorls five or six, depressed, ventricose smooth,—the last one large, and, when measured from the lower angle of the aperture, equal to half the whole length. Length of the only specimen collected, fourteen lines; diameter of last whorl, four lines. The surface, judging from the appearance of a small fragment of the shell, must be smooth, or very finely striated.

In this species the whorls are not so convex as they are in *M. gracilis*, and the last one is proportionally larger.

Locality and Formation.—Grand Isle, near Cornwall. Chazy Limestone.

Collector—J. Richardson.

Murchisonia perangulata? (Hall.)

Murchisonia perangulata (Hall), *Palæont. N. Y.* Vol. 1, page 41. Plate 10, Fig. 4.

Several specimens have been collected which closely resemble those found in the Black River Limestone, but are a little larger than the average size.

Locality and Formation.—Mingan Islands. Chazy Limestone.

Collectors—Sir W. E. Logan, J. Richardson.

Murchisonia asper, N. s.

Description.—Obtusely conical; apical angle about 70°; spire of four or five whorls,—the body whorl large, ventricose, with a prominent band about the middle, and a low angular carina at about two-thirds the distance between it and the suture above. The upper whorls small, rapidly tapering to an acute apex, and altogether forming only one-fourth or less of the whole length. The band on the body whorl of a specimen a little more than one inch and a half long is two lines wide, and consists of a central rounded ridge one line wide, with an obscurely angular carina on each side. The surface is ornamented with fine sharp lines of growth from six to eight in the width of one line, which, in descending, curve gently backward until they reach the band; below which they curve abruptly forward for about two lines, then become vertical or nearly so, and again curve backward on approaching the aperture. They are thin, sharp, imbricated, and very distinct. The aperture, as exhibited in a single specimen, is nearly circular, the lower part somewhat effuse, the inner lip entire and a little separated from the body whorl.

A full-sized individual is twenty lines in length, of which, on the anterior side, the aperture and body whorl occupy full fifteen line, and the remainder of the spire to the apex only five lines; but on the opposite side, the spire, from the body whorl upwards, is seven lines. The width, measured across at one line above the upper angle of the aperture, is eleven lines. The shell in this specimen, at the lower side of the body whorl, is one line and a half thick.

In some of the fragments of other specimens there appears to be a wide, but very shallow, concave band just below the principal band on the body whorl, and below this an obscure carina. The main band also varies a little in its proportional width and

angularity. Owing to the thickness of the shell the sutures above the body whorl are not deep, and the upper whorls are in consequence not ventricose, but still encircled with the band—apparently, also, with the upper carina. In the cast the whorls are smooth rounded ventricose, and exhibit scarcely any trace of either the band or the carina. In some specimens the shell on the body whorl exhibits some deep, irregular undulations of growth.

Resembles both *M. helicteres* (Salter) and *M. bicincta* (Hall); but these species have a distinct carina below the band.

Locality and Formation.—Mingan Islands. Chazy.

Collectors—Sir W. E. Logan, J. Richardson.

The other gasteropods of the Chazy are two species of *Holopea* and *Trochonoma umbilicata* (Hall, sp.)

MACLUREA ATLANTICA, (N. s.)

Description.—Whorls about four, flat or gently convex on the lower side, ventricose above, and obtusely angulated at the edge of the umbilicus. In a specimen with four whorls the diameter is three inches and seven lines; the width of the last whorl at the aperture, on the flat, lower side, is sixteen lines; at the termination of the third whorl six lines, and of the second whorl three ines. The first whorl occupies about two lines of the diameter in the centre. In the same specimen, if on a line drawn from the aperture straight across the shell, the width from the outside of the aperture to the centre is two inches and two lines, and from the centre to the termination of the line on the posterior side one inch and three lines.

When the above dimensions are compared with those of *Maclurea Peachii* (Salter), as figured in the Quarterly Journal of the Geological Society, vol. 15, plate 13, fig. 1*a*, the difference between the species at once becomes obvious. That figure represents a specimen of *M. Peachii*, which is exactly three inches and seven lines in diameter; but it has five whorls, the width of the last one at the aperture being twelve lines, and of the others measured on the same line 6, 3, $1\frac{3}{4}$ and 1 lines respectively. *M. Peachii* is, therefore, a distinct species, differing from ours by its more numerous and more slender whorls.

The operculum found associated with the specimens is elongated, flat or a little concave on one side, moderately convex on he other, curved like a short Cyrtoceras, but not in the same

plane,—the apical half being gradually turned towards the flat side, so as to constitute a sub-spiral curve. The width at the base of the most perfect specimen collected is sixteen lines, thickness nine lines; length along the outer curve four inches, from the apex in straight line to the inner angle at the base fifteen lines, and to the outer angle two inches and three lines. On the convex side the structure is seen to consist of successive thin laminæ at right angles to the length, the unequal development of which forms a sort of a squamose and transversely undulated surface. This operculum resembles that of *M. Peachii*, but it is larger and more strongly curved. I have seen no perfect specimens.

While the differences in the size of the whorls distinguished this species from *M. Peachii*, its operculum shews at a glance that it cannot be either *M. Logani* or *M. Magna.*

I have seen no specimens with the shell preserved. In the cast of the interior the inner whorls are quite ventricose, instead of flat, in some of the individuals; but in others, from the same locality, nearly flat.

Locality and Formation.—Mingan Islands. Chazy Limestone.

Collectors—Sir W. E. Logan, J. Richardson.

There are apparently two other species of *Maclurea* in the Chazy, one of which may be *M. Logani* and the other *M. Magna*; but they require further examination.

CEPHALOPODA (15 species).

ORTHOCERAS SHUMARDI, N. s.

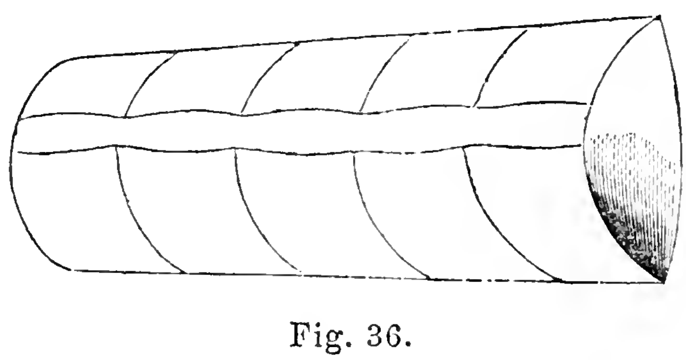


Fig. 36.

Fig. 36.—Longitudinal section of *O. Shumardi*, shewing the distance of septa and the position of siphuncle.

Description.—Elongate, cylindrical, section circular, tapering at the rate of a little more than half a line to the inch, septa rather strongly convex, distant nearly half the diameter; siphuncle about one fifth the whole diameter, and with its centre distant from the

centre of the trausverse section half its own diameter. Surface unknown.

In a specimen eight inches long the diameter of the larger extremity is ten lines and of the smaller five lines, and it tapers therefore at the rate of five eighths of a line to the inch. At the larger end there are two septa in nine lines, and at the smaller two in four lines. The siphuncle is cylindrical and but slightly inflated between the septa; its diameter at its passage through the septum at the large end one line and a half, and between the septa about two lines.

We have no species with which this Orthoceratite can be compared except *O. amplicameratum* (Hall), from which it differs in having the septa proportionally a little more distant, and the siphuncle a little larger and not so excentric.

Dedicated to the excellent geologist and palæontologist, Dr. B. F. Shumard, State Geologist of Texas.

Locality and Formation.—Mingan Islands; Chazy.

Collectors.—Sir W. E. Logan, J. Richardson.

ORTHOCERAS MARO, N. sp.

Description.—Annulated, slightly curved, section circular, tapering at the rate of one line and a half to the inch; siphuncle about one eighth the whole diameter, and with its centre half its own diameter from the centre of the shell; septa rather strongly concave, two in five and a half lines where the shell is one inch in diameter, three in five lines where it is half an inch in diameter.

The annulations in general encircle the shell at right angles to the length, but in some of the specimens they appear to be gently sinuated on one side. They are rather abruptly elevated with rounded edges, and the spaces between them are either regularly concave or nearly flat for about one fourth or one third their width in the middle or at that part of the bottom of the space which is situated half way between the annulations. The thickness of the rounded edge of the annulations is about half a line and the height of the ridge about one line. Where the diameter is one inch the annulations are distant three lines, and where it is half an inch they are distant one line and a half.

The surface is ornamented with fine longitudinal striæ, about ten in the width of one line. These striæ are in some places alternately a little unequal in size, and they also appear to be crossed by minute transverse striæ, but this character has not been

yet positively established. The longitudinal striæ are continuous over the edges of the annulations. The segments of the siphuncle are moderately inflated between the septa.

Where the diameter is one inch the depth of the concavity of the septa is equal to the distance between them, or a little less, but towards the smaller extremity the septa are not so strongly concave.

The amount of the curvature of the shell appears to be a little variable, but the average in the three specimens I have examined would be equal to that of an arch with a base of eight inches and an elevation of three lines in the middle.

This species seems to be allied to *O. annellum* (Conrad), but the figures given in the "Palæontology of New York," volume 1, plate 43, shew that the spaces between the annulations in that species are not concave. Figure 6*a* on the plate cited has sharp-edged annulations with angular constrictions between. Fig. 6*d* shews broadly-rounded annulations, with sharp angular constrictions. If these figures be correct they represent two very different species, and neither of them identical with the one above described. Neither Hall nor Conrad state whether the inter-annular spaces in *O. annellum* are concave or not.

Locality and Formation.—Mingan Islands; Chazy limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

ORTHOCERAS MULTICAMERATUM (Conrad).

This species occurs at the Mingan Islands, and also on the Island of Montreal in the Chazy limestone; also in the Black River limestone in the township of Westmeath.

ORTHOCERAS BILINEATUM (Hall).

Occurs in the Chazy at Mingan; in the Black River limestone at La Petite Chaudière near Ottawa, and at Pauquette's Rapids. In the Hudson River group at Cape Smith, Lake Huron.

ORTHOCERAS SUBARCUATUM (Hall).

This species has been found in the Chazy on the island of Montreal and near Cornwall. The surface characters are not well known, but one of the specimens exhibits the siphuncle, which is strongly moniliform, and situated half way between the centre and the outside. All the specimens that I have seen are curved.

ORTHOCERAS MINGANENSE (Billings.)

(O. MINGANENSE, *Report* G. *S. C.*, 1856, page 319.)

Occurs in both Chazy and Black River limestones at the Mingan Islands.

ORTHOCERAS ALLUMEITENSE (Billings).

(O. ALLUMETTENSE, *Report G. S. C.*, 1856, page 331.)

Description.—Section nearly circular, tapering at the rate of one line and a half to the inch; siphuncle moniliform eccentric, its centre distant from the centre of the shell half its own diameter; septa convex, from two to two lines and a half distant; surface apparently smooth.

In a specimen three inches long, thirteen lines in diameter at the larger and eight and a half lines at the smaller extremity, the dilations of the siphuncle are four lines wide, and the distance of the septa gradually diminishes from two and a half to two lines. On its passage through the septa the siphuncle is constricted to the diameter of one line, and the segments or expansions between the septa are discoid, with rounded edges, each being a sphere compressed at opposite sides. The inner margins of the segments of the siphuncle are in contact with a line drawn longitudinally through the centres of the septa. The outer margin is distant from the centres of the septa the whole diameter of the siphuncle. The segments of the siphuncle are not disposed at right angles to the length of the shell, but obliquely, sloping from the outside inwards and towards the apex or smaller extremity.

Locality and Formation.—Chazy sandstone at Aylmer and township of Clarence; Black River limestone, Pauquette's rapids.

Collectors.—Sir W. E. Logan, J. Richardson, E. Billings.

ORTHOCERAS ANTENOR, N. s.

Description.—The only specimen of this species that I have seen is eight inches in length, and tapers from fourteen lines at the larger to four and a half lines at the smaller. The two septa visible at the larger extremity are distant two lines and two thirds. The surface is beautifully cancellated by fine but distinct longitudinal lines, about twelve to one line, crossed at right angles by much finer but still distinct encircling striæ. The shell is curved so as to form an arch, of which the base is eight inches and the height in the middle eight lines.

Locality and Formation.—Chazy limestone, Mingan Islands.
Collectors.—Sir W. E. Logan, J. Richardson.

Besides the above, there are three other species of Orthoceras in Chazy limestone, of which one resembles *O. Ottawaense*, and may yet turn out to be the same.

Genus NAUTILUS.

In the genus *Trocholites* (Conrad) the siphuncle is internal, in *Nautilus* central, and in *Cryptoceras* (d'Orbigny) external. There are many palæontologists who think that the first and last of these should be retained as genera or sub-genera distinct from *Nautilus*, while others are of opinion that all should be comprised under one name. The position of the siphuncle can hardly be regarded as of generic importance. In *Cyrtoceras* and *Phragmoceras* it is dorsal, central, or ventral. If we should divide *Nautilus* into three genera, according to the position of the siphuncle, then *Cyrtoceras* and *Phragmoceras* must also be subdivided in order to make our genera of equal value. We would thus have nine genera where there are only three. Professor Chapman of Toronto was the first to direct attention to the fact that *Lituites undatus* (Hall), and another species which occurs at Lorette and which I had considered to be identical with Hall's species, do not belong to *Lituites*, but rather to d'Orbigny's genus *Cryptoceras**. This view is confirmed by several other specimens collected since Prof. Chapman's article was written; and should *Cryptoceras* be retained, at least two of the following species must be referred to it, since both have an external siphuncle. In the other, (*Nautilus natator*), it has not been observed. I have examined all our specimens carefully in order to ascertain the direction of the bent portion of the septa around the siphuncle, but, owing to their imperfection, without success. Should it be found hereafter to be directed forward, then the species must be transferred to Barrandé's new genus, *Nothoceras*.

NAUTILUS JASON, N. S.

Description.—Discoid, planorbiform, all the whorls exposed in the umbilicus. Section of shell broad oval, the ventral and dor-

* On the occurrence of the genus *Cryptoceras* in Silurian Rocks. By E. J. CHAPMAN, Professor of Mineralogy and Geology in University College, Toronto. *Canadian Journal*, 2nd series, vol. 2, page 264; and in *Annals of Natural History*, 2nd series, vol. 2, page 114.

sal sides being depressed convex, the other two sides rounded, the two diameters being to each other as fifteen to seventeen. The tube increases in diameter at such a rate as to give to the coil a diameter of three inches and a half on the completion of the second whorl, at which point the septa are two lines distant from each other in their centres, two and a half lines in the middle of the ventral side, and a little less than one and a half lines on the dorsal or inner side of the whorl. They become gradually more approximate as they appreach the apex, so that where the tube is half an inch in diameter they are one line distant in their centres. They are only moderately convex, and their edges cross the ventral aspect in a straight line, but on the sides with a gentle curve towards the apex of the shell.

The surface exhibits a series of rounded ridges which, starting from the umbilicus, curve backward, and make a deep rounded undulation towards the apex on the ventral aspect. The distance of the ridges from each other along the median ventral line is about five lines, and the intervening spaces are shallow and concave. The surface is also marked with obscure fine striæ, and smaller ridges all parallel with the larger.

The siphuncle is from one and a half to two lines in diameter, cylindrical, not inflated, and distant about two lines from the outer margin.

On comparing this species with the figures of *L. undatus* (Emmons), given in the Palæontology of New York, vol. 1, plate 13, we find that our best preserved specimen is exactly the size of figure 1; that the ventral aspect is not angular at the sides, nor do the ridges pass straight across, as shewn in fig. 1*b*; and that in fig. 3 the septa are more than three lines distant in their centres instead of two lines, as they are in our specimens. The specimen represented on plate 13 *bis* has the septa three and a half lines nearly distant about the completion of the second whorl, while those next the chamber of occupation are more approximate, as they usually are in all the Nautilidæ. Our species therefore, although closely allied, is a distinct species from *L. undatus*.

Locality and Formation.—Mingan Islands; Chazy limestone.

Nautilus tyrans, N. s.

Description.—Discoid planorbiform, all the whorls exposed in the umbilicus. Shell increasing in size, so that at the completion

of two whorls and a half the diameter of the coil is eight inches. Whorls contiguous, but in the cast of the interior not in contact; transverse section of the tube nearly circular; siphuncle ventral, and at the completion of second whorl, in which place only it can be seen in the specimen, about three lines in diameter, and one line or a little less from the margin. At the same point the septa, as marked upon the siphuncle, are six lines distant from each other. The shell is not preserved, but from the smoothness of the cast I think there can be no transverse ridges, as there are in *L. Jason* and *L. undatus.*

Only a single specimen of this fine species has been collected, and that is a cast in which none of the septa can be seen. Its great size, the separation of the whorls in the cast, and the absence of undulating transverse ridges, are abundantly sufficient to distinguish it from any other described species of the Lower Silurian rocks of North America.

Locality and Formation.—Mingan Islands; Chazy limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

NAUTILUS NATATOR, N. S.

Description.—Discoid planorbiform, all the whorls exposed in the umbilicus. Tube slender, gradually increasing in size, so that on the completion of the fifth whorl the diameter of the coil is four and one fourth inches. Section oval, the dorso-ventral diameter being greater than the lateral in the proportion of about 8 to 6 (?) Septa at the end of fourth whorl, three in about seven lines, measured on the side. Surface and siphuncle unknown.

The specimen is imperfect; but if it has not been compressed laterally, then, as nearly as I can determine, the dorso-ventral diameter at the end of the fifth whorl is sixteen lines and the lateral twelve; at the fourth whorl five to seven; and it would appear therefore that the third must be scarcely three lines in its greatest diameter.

I have not seen the first and second whorls, but as there is an empty space nine lines in diameter in the centre of the coil I presume that they did once exist and occupy that space. The whorls are in contact, but the outer ones are not indented by those next preceding.

Locality and Formation.—Mingan Islands; Chazy limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

Cyrtoceras McCoyi, (N. s.)

Description.—Of this species I have seen no specimens with the smaller extremity preserved, and cannot therefore give the amount of curvature. The best specimen is fusiform, nearly straight, and two inches and a half in length. The section is oval, the greatest (dorso-ventral) diameter at the aperture is eleven lines, and the lesser apparently about eight lines. From the aperture the shell gradually increases in diameter until at the first septum or at the bottom of the body chamber, the dorsa-ventral diameter is 13 lines, and the transvesse diameter about 11. It then tapers to the diameters of 6 and 5 lines in the next 18 lines of the length. The ventral side is curved so as to form an arch, with a height of three lines in a span of 2½ inches; the dorsal side is much more gently arched. The septa are very gently concave, and one line distant from each other. The siphuncle is moniliform, 1 line in diameter, and almost in contact with the shell on the ventral side. Surface unknown. Differs from *Cyrtoceras* (Oncoceras) *constrictum* (Hall) in being proportionally more slender.

Dedicated to the eminent Palæontologist, Professor F. McCoy, author of that excellent work, the British Palæozoic Fossils.

Locality and Formation.—Chazy Limestone, Mingan Islands.

Collectors.—Sir W. Logan, J. Richardson.

Crustacea (14 species).

The trilobites of the Chazy limestone are usually found in fragments; but the abundance of the remains shews that the individuals were numerous. There appear to be about seventeen species.

Illænus Bayfieldii, *I. globosus*, *I. clavifrons*, *I. arcturus*, and *Amphion Canadensis*, have been already described: but besides these there are the following:—

Four species of *Asaphus*, one of which appears to be *A. platycephalus*.

Several fragments of a large species of *Lichas*.

One species of *Cheirorus*, and part of a head, genus not determined.

Bathyurus Angelini (N. s.)

Description.—Oval, the posterior angles of the head produced into short spines; length from one to two inches.

Head convex, semicircular, or rather crescentiform, the posterior angles being produced backwards; glabella sub-cylindrical, rounded, and abruptly elevated in front, the sides nearly parallel, crossed by a narrow, rather deep neck-furrow near the posterior margin; two indistinct oblique lateral furrows. On a side view, the outline is nearly straight, or scarcely at all convex from the posterior margin to near the front, when it descends with an abrupt curve to the edge of the narrow marginal furrow which runs round the whole of the head, close to the edge.

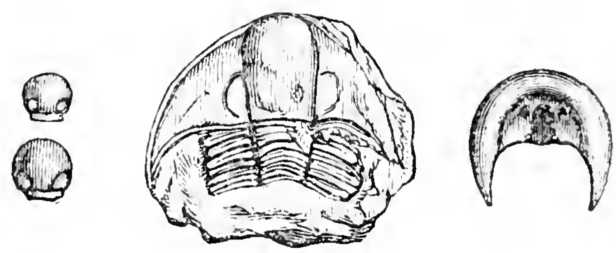


Fig. 36, 37, 38.

Fig. 36.—Two specimens of the glabella of a small trilobite from the Chazy Limestone; genus not determined.

37.—Fragment of *Bathyrus Angelini.*

38.—*Harpes antiquatus.*

The eyes as indicated by the course of the facial suture, are large, crescentiform, and a little more than one-third the whole length of the head. The anterior angles of the eyes appear to be a little in advance of a line drawn across the glabella at half its length, while the posterior angles are a little in advance of the neck-furrow.

The thorax is not well known. From several fragments of it the central lobe appears to be cylindrical, strongly convex, a little wider at the anterior than at the posterior extremity.

The pygidium is strongly convex, and closely resembles that of *B. extans.*

Allied to *B. extans* (Hall. sp.), but that species has the posterior spines of the glabella of great length, extending backwards to the pygidium.

Dedicated to M. P. Angelin, the eminent Swedish Palæontologist.

Locality and Formation.—Grenville; Chazy limestone, Grenville and Fitzroy Harbour.

Collectors.—J. Richardson, Sir W. E. Logan.

Harpes antiquatus.

Description.—Of this species we have only the head, with its horse-shoe-shaped border. The length from the front margin to a line connecting the two posterior points of the border is five lines, and to the posterior margin of the glabella nearly three lines; the width at the posterior margin of the glabella is five lines and one fourth.

The head, including all that portion of the border which lies in front of a line drawn across at the posterior margin of thé glabella is nearly a perfect semi-circle. Behind the same line the margin curves inward, so that the two posterior points are only three lines distant from each other. The glabella is small, conical, obtusely rounded in front, strongly convex, with a distinct neck-furrow crossing it close to the margin; length one line and one fourth, width at base five sixths of a line. There appears to be a small sharp tubercle situated on the neck segment, and also a small rounded lobe on each side of the glabella at the neck furrow.

The eyes are small, about one sixth of a line in diameter, each apparently situated on the top of a small eminence. A line connecting the eyes would cross the glabella at about one sixth of its length from the front. The distance between the eyes is about equal to the width of the glabella at the neck segment.

The upper surface of the border has not been seen, but judging from the lower side, its width must be about one line in a specimen of the size above described. On the underside it appears to be nearly smooth or minutely granulated, but under an ordinary pocket lens small, closely crowded, circular punctures make their appearance.

Locality and Formation.—Mingan Islands; Chazy limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

Fragments of another species of *Harpes* have been found at Montreal, in Chazy limestone.

Entomostraca (4 species).

Leperdita Canadensis (var. *nana*,) (Jones), *Beyrichia Logani* (Jones), *Isochilina Ottawa* (Jones), and *Leperdita amygdalina* (Jones), have been described in Canadian Fossils, Decade 3.

Annelida (1 species).

SERPULITES SPLENDENS (N. S.)

Description.—This fine species is seven or eight inches in length and about one fourth of an inch in thickness at the larger extremity, usually gently curved, and gradually tapering apparently to an acute point; the surface beautifully ornamented with fine transverse striæ, of which there are ten or twelve in the length of one line. The colour of the shell is jet black and shining where the surface is preserved. The specimens are usually imperfect, and are sometimes found spirally twisted.

Mr. Hunt has ascertained that they are composed largely of phosphate of lime.

This species is much like *Serpulites longissimus* (Murchison), but not so much curved.

Locality and Formation.—Island of Montreal, and at Caughnawaga.

Collectors.—Sir W. E. Logan, E. Billings.

ARTICLE XXXV.—*Archaia; or Studies of the Cosmogony and Natural History of the Hebrew Scriptures.* By J. W. DAWSON, LL.D., F.G.S., Principal of McGill College; Author of Acadian Geology. Montreal: B. Dawson & Son' London: Sampson Low, Son & Co. With an Appendix, pp. 406.

We hail the publication of this book as the beginning of a new period in the Literary History of Canada.

The works that have hitherto been issued from our press have almost entirely pertained to historical and other questions of either local or provincial importance. Some of these have undoubtedly been of a high order of merit and have redeemed our country from the charge of literary barrenness. So far as Civil, Geographical and Natural History is concerned, we are not behind the age in which we live. We have added something to the sum of human knowledge in these departments, and our fame has reached the high places of European and American Science. In polite Literature we may not yet have contributed much that claims the attention of the civilized world, still we have done enough to show that the germs of literary life exist among us; and as this species of letters is rather the inflorescence, than the first growth

of a nation's culture, we may expect that as our population increases and the influences of our Schools and Universities are more generally diffused, we shall attain to a respectable standing in the province of "Belles Lettres," The advent of "Archaia" indicates a decided step in literary progress. Here is a work not on any local question for which, irrespective of its merits, a circle of indulgent readers may be secured, but one embracing fields of investigation of universal interest and challenging the attention of both religion and science. We congratulate ourselves that a colonial author has been found capable of grasping with a firm hand questions at once profound and intricate and of treating them in their multifarious bearings with clearness and force. Whatever opinions may be entertained of the speculations which this volume contain, there will, we are persuaded, be but one opinion as to the thoroughness with which its topics have been discussed, the patient labour which has been bestowed on every section, the eloquence with which many of its truths are stated, and the wide and accurate knowledge of contemporary science which it manifests. Our author has not given crude and ill-digested speculations to the world, or claimed the attention of his fellows to that which he himself has not completely mastered or regarding which he has not something new and important to say. The reader may take up this book with confidence that he will find in it truths of vital importance to Christianity, together with the latest and highest inductions of science in its bearings on religious faith, detailed in well conceived and carefully expressed terms.

The preface informs us that "this work is not intended as a treatise on elementary Geology with Theological applications nor as an attempt to establish a scheme of reconciliation between Geology and the Bible. It is the result of a series of exegetical studies of the first chapter of Genesis in connection with the numerous incidental references to nature and creation in other parts of the Holy Scriptures." Undertaken primarily for the author's private information these studies "are now published as affording the best answer which he can give to the numerous questions on this subject addressed to him in his capacity as a teacher of Geology."

From this it will be seen that the book does not embrace all the references in Scripture to important physical phenomena. The field of view is, as we think, advantageously limited and confines attention to a particular circle of things and events which, if

they can be satisfactorily interpreted and determined, will afford a key for unlocking the difficulties connected with other physical phenomena to which allusions are made in the Bible. The narrative of the creation is besides so complete in itself, so definite and precise, that it invites a special and individualized treatment. It has the advantage of being brief and yet profoundly comprehensive. Its sentences are themes which involve at once the highest objects of faith and science. It cannot but be regarded as an incidental evidence of inspiration that a subject of such vastness and sublimity should have been so fully delineated in a few bold and graphic sketches.

It augurs well for the science of the present day that in its rapid advances towards the conquest of nature, it is not content to detach itself from the revealed writings. There seems to be an underlying conviction in the minds of almost all scientific men that somehow the Book of Nature, whose characters it is their business to decipher, is the counterpart of that manifestation of the Creator which is contained in the Bible. The very general conclusion is therefore, that there can be no contradiction between the righty understood facts of the one and the statements of the other. This conviction has led men of science to give an unusual attention to biblical interpretation. We can remember scarcely a name of any note in the several departments of science, which is not also associated with speculations concerning the relations of science to the records of revelation. When further we look at the religio-scientific labours of men whose training has been purely or chiefly scientific we notice two tendencies in their views of the Divine Record. One is that which would make it mean less than has been generally supposed by the christian world, and another which would make it mean more. That this is the fact any one acquainted with the literature of science during the past twenty five years will at once admit. We know of no one eminent in science, (excepting it may be Mr. Gosse, and he is a zoologist) who has retained the old faith concerning the Cosmogony of Genesis. These opposite and contradictory tendencies among the interpreters of nature in the application of their own discoveries to the elucidation of Scripture have greatly confused and perplexed many devout and unscientific Christians. Holding, as most good men do, the facts of science in great respect, they know not what to make of the very confident statements of the scientific regarding that Record on which they

place an undoubting faith. The result is that the common Christian mind looks with suspicion upon science and questions the veraciousness of its alleged facts. Whenever the statements of science are brought into collision with those of Scripture devout people hold by their Bibles, let science say what it list. Their motto is: "Let God be true but every man a liar." This is very much the state of the general christian mind at the present day regarding the scientific interpretation of the Mosaic account of the creation. It is remarkable that although attempts have been made for nearly half a century to reconcile the record in the Word with the record in the Rocks, christian men for the most part retain nevertheless very much the old convictions concerning the biblical account of creation, and none of the theories of interpretation which have yet been propounded have gained anything like a general acceptance. A few of the more enlightened may be prepared to modify old interpretations in accordance with the light of modern science, still, but few are quite clear as to the precise idea they ought, in deference to the teachings of science, to attach to the Bible record. Few ministers yet venture from the pulpit to teach any other than the old views, and we know of no commentator of any note who does more than allude to the scientific interpretations of creation. To some this state of things may appear to be a tacit acknowledgment on the part of religious men of the weakness of their position and of the potency of scientific facts—a kind of confession that the investigations of science are undermining the foundations of christian faith. Such an inference would however be a grand mistake. For at no time since the beginning of this æra have the foundations of religious belief been regarded as more secure that they are at the present day. At no time indeed since the revival of literature and science in Europe has religion more bravely welcomed into its temple of truth the clear inductions of science. Other reasons than those of weakness and fear must therefore be assigned for the general non-acceptance of scientific interpretations of Scripture.

The reason we would assign is one that has its seat deep in the christian consciousness of sincere men—it is that these scientific interpretations to a greater or less degree violate the plain common sense meaning of the language of Scripture. There are, it is allowed, certain modifications of the literal sense of words which ordinary minds can at once appreciate because they are in accordance with the forms of every day speech—figurative and secondary

meanings of words, for example, within reasonable limits are at once understood and accepted, but when it is demanded, in obedience to scientific necessity, that words which appear as literal as language can make them, should be received in a figurative or tropical sense, then it is that the christian consciousness revolts, and arms itself in defence of the foundations upon which it rests its faith—it will not admit a principle of interpretation in Genesis which is not equally applicable in the Gospels or Epistles.

So long as Geology, or science of any kind, demands, as a condition of its alliance to religion, that violence should be done to the plain and obvious meaning of the words of Scripture so long will science find that the common christian consciousness of the world will be ranged against its authority.

It is to be regretted, as our author more than once mentions, that scientific studies have been so much neglected by the great mass of religious teachers and biblical expositors. Still it must be said in defence that our best divines were fully up to the science of their own day. If judged of not by modern standards, but by the standard of their time they will be found by no means despicable in their knowledge of nature. With contemporary physicians whose department was physics, they will bear a favorable comparison as to their knowledge of Natural History and general science. We allow that the science of the present day has rather gone ahead of the great bulk of christian teachers and of most of our popular commentators. Literary and theological studies have in many cases altogether excluded the study of Natural Science. In the regard of some, time is wasted that a student might spend among the objects of nature. And there are good people even now, who think disparagingly of a minister who is known to cultivate for the enlargement of his mind a scientific acquaintance with the works of the Creator.

But this state of things is fast passing away. Divines of this generation are treading closely on the heels of the professed cultivators of science. It is no uncommon thing to find the title of Revd. attached to the name of distinguished authors in many departments of science. Men are rising up as teachers of religion who can bring to their professional studies all the collateral lights of modern science.

Natural Science is after all but modern. In the realms of thought it is yet but an infant of days and has only recently been brought out of the wilderness. Or to change the figure its diffused and

glimmering rays have only a few years ago been gathered into lights great and small in the firmament of truth. If the conservative religious spirit of the age has not quite been able to keep pace with its progress, this has been partly because science has somewhat broken loose from its natural espousals with religion, and partly because the sagacious spirit of christianity always climbs with a cautious step the airy heights of human knowledge. The princes of science need not therefore chide very sharply the more venerable if more tardy priests of the christian faith.

We have been led into these remarks partly in sympathy with many of the wise and truthful statements in the introductory chapters of "Archaia," and partly by the slightest possible objection we have to some sentiments which it contains bearing upon the treatment of science by the teachers of religion. Not that we decidedly object to any statements advanced by our author, but that we would wish to supplement them with kindly apologies for the cautious and it may be unscientific student of theology.

It is now time however to bring before our readers the *special* objects aimed at by this thoughtful and genial book. On this point we shall permit our author to speak for himself.

"There can be no question that the whole subject (Biblical cosmogony) is at the present moment in a more satisfactory state than ever previously; that much has been done for the solution of difficulties; that theologians admit the great service which in many cases science has rendered to the interpretation of the Bible, and that naturalists feel themselves free from undue trammèls. Above all, there is a very general disposition to admit the distinctness and independence of the fields of revelation and natural science, the possibility of their arriving at some of the same truths, though in very different ways, and the folly of expecting them fully and manifestly to agree, in the present state of our information. The literature of this kind of natural history has also become very extensive, and there are few persons who do not at least know that there are methods of reconciling the cosmogony of Moses with that obtained from the study of nature. For this very reason the time is favourable for an unprejudiced discussion of the questions involved; and for presenting on the one hand to naturalists a summary of what the Bible does actually teach respecting the early history of the earth and man, and on the other to those whose studies lie in the book which they regard as the word of God, rather than in the material universe which they regard as his work, a view of the points in which the teaching of the Bible comes into contact with natural science, at its present stage of progress. These are the ends which I propose to myself in the following pages, and which I shall endeavour to pursue in a spirit of fair and truthful investigation; paying

regard on the one hand to the claims and influence of the venerable Book of God, and on the other to the rights and legitimate results of modern scientific inquiry." (page 14.)

After this we have a most valuable chapter on the "objects, character and authority" of the scriptural views of the physical phenomena of the world, in which are discussed with much fullness and force questions that lie within the domain of what in modern times is called Biblical Prolegomena. Every point is looked at with the eye of a Christian Naturalist. Topics of weighty importance are here introduced to the reader which do not generally come within the range of ordinary reading, and are presented in such relations as to interest and impress the mind. The regions of esoteric debate which though mainly interesting to scholars and belonging to a kind of third heaven of religious culture, are here opened up in many of their practical bearings upon religious faith. Attentive readers will we are persuaded rise from the perusal of this part of "Archaia" with a more profound reverence for the sacred volume, and with minds refreshed and enlarged with far-reaching and beautiful aspects of its cosmical truths. Of many passages marked for quotation we present the following as worthy of note :—

"The references to nature in the Bible, however, and especially in its poetical books, far exceed the absolute requirements of the reasons above stated ; and this leads to another and very interesting view, namely, the tendency of monotheism to the development of truthful and exalted ideas of nature. The Hebrew theology allowed no attempt at visible representations of the Creator or of his works for purposes of worship. It thus to a great extent prevented that connection of imitative art with religion which flourished in heathen antiquity, and has been introduced into certain forms of christianity. But it cultivated the higher arts of poetry and song, and taught them to draw their inspiration from nature as the only visible revelation of Deity. Hence the growth of a healthy "physico-theology," excluding all idolatry of natural phenomena, but inviting to their examination as manifestations of God, and leading to conceptions of the unity of plan in the cosmos, of which polytheism, even in its highest literary efforts, was quite incapable. In the same manner the Bible has always proved itself an active stimulant of natural science, connecting such studies, as it does, with our higher religious sentiments ; while polytheism and materialism have acted as repressive influences, the one because it obscures the unity of nature, the other because, in robbing it of its presiding Divinity, it gives it a cold and repulsive, corpse-like aspect, chilling to the imagination, and incapable of attracting the general mind." (page 19.)

Again in speaking of the literary character of the scriptural cosmogony our author says:—

"The labours of the ablest biblical critics give us every reason to conclude that the received text of Genesis preserves, almost without an iota of change, the beautiful simplicity of its first chapter; and that we now have it in a more perfect state than that in which it was presented to the translators of most of the early versions. It must also be admitted that the object in view was best served by that direct reference to the creative fiat, and ignoring of all secondary causes, which are conspicuous in this narrative. This is indeed the general tone of the Bible in speaking of natural phenomena; and this mode of proceeding is in perfect harmony with its claims to divine authority. Had not this course been chosen, no other could have been adopted, in strict consistency with truth, short of a full revelation of the whole system of nature, in the details of all its laws and processes. Had this alternative been adopted, who could have read or comprehended the vast encyclopedia which would have been produced. The moral ends of a revelation would have been sacrificed, and we would have been excluded from the fresh and exciting exploration of actual nature." (page 29.)

On the difficult subject of the inspiration of Scripture, this book gives no uncertain sound. While insisting that science should enter upon its investigations with an untrammelled and fearless freedom, it at the same time bows with submission to the revealed word of God. It shows clearly "that there is no hypothesis short of that of plenary inspiration that will allow us to attach any value whatever to the biblical records," and that they could not have been the result of ancient scientific enquiries or intuitive knowledge. While the primitive civilization was by no means despicable it yet can not be said to have attained to such a knowledge of the laws and phenomena of the universe as could constitute a basis for the cosmogony of Scripture. Our author justly remarks that the narrative of creation "bears no internal evidence of having been the result of inductive enquiry, but appeals at once to faith" ......"it refers to conditions of our planet respecting which science has even now attained to no conclusions supported by evidence, and is not in a position to make dogmatic assertions." In regard to the mythical hypothesis, the great dream of German infidelity, he combats the views of Prof. Powell of England, and points out the fallacy of many of that able writer's positions. The mythic theory is however one that science is least competent to deal with. History and Philology are the true weapons with which to confront it. By these the Germans themselves have achieved a signal victory.

An important point now comes up for consideration in relation to the authority of the record, namely: in what sense the allusions to nature contained in it are entitled to be regarded as having the authority of inspiration? Do they merely represent the knowledge of nature existing at the time, or are they the result of a "divine afflatus?" Our author is disposed to take a higher view than the first, and as a naturalist, to form a much higher estimate of the references to nature embodied in the Scriptures. This we regard as a most satisfactory statement. It does not go the length of saying that the representations of nature in the Bible are *revelations*, but only that they have been recorded under the guidance of *inspiration*. This we conceive is the true position to take. We do not find the Creator revealing that which can be discovered by the faculties he has given us. In all His relations with men, he honors, much more than philosophers do, the wonderful organs of perception with which he has endowed the human race. The Creator has faith in human eyes and ears. He knows that they are "*very good.*" In regard to those things, therefore, which lie within their reach, he gives no *revelation*, but when such things stand related to the spiritual truths which pertain to the moral government of mankind, then he so guides the prophets that no human weakness or prejudice shall mar the perfect action of their perceptive organs. Besides this, we never find the Creator choosing fools for his prophets. Making every allowance for the exaltation of mind which inspiration must produce, we yet find in all the messengers of God evidence of high mental capacity and of a special mental training for the services to which they had been summoned.

Taking this view of the question we may expect to find in the Bible allusions to natural phenomena, which in their truthfulness rival the demonstrations of natural science.

But we must now, preparatory to some criticism, of our author's views on the meaning of the terms in the first chapter of Genesis, make a preliminary statement which we deem of the utmost consequence in the discussion of the topics contemplated, namely, *that the language of Scripture in all its allusions to and descriptions of nature is always and entirely the language of appearances—in its body and substance it is the result of actual experience—of "optical impressions of nature."* This statement has been frequently made by others, and is incidentally noted by our author, but it has not, as we think, been sufficiently insisted

on, or faithfully applied, as a canon of sacred criticism. It is the canon which, to the universal satisfaction of the christian world, has reconciled the statements of Scripture with the Copernican theory and the final inductions of Astronomy. After mature reflection we are persuaded that it is the only canon by the sober application of which the statements of Scripture can be interpreted in perfect harmony with the facts and final determinations of geology. When the inspired writers speak of the heavens, the stars, the planets, the clouds; of storms, earthquakes and volcanoes; of mountains, valleys, seas and rivers; they, to our thinking, speak of them precisely as they appeared—their words are descriptive of what they saw; they give true evidence of the facts which nature presented to their eyes; they propound no theories as to the secondary causes of things, but when they advert to causes at all they at once "rise from nature up to nature's God." The Creator did not reveal to them mediate or secondary causes, and he preserved them from speculating like philosophers about them. If they had speculated the consequence would have been that, destitute as they were of both revealed and scientific knowledge of such things, they would have rendered the Bible no more trustworthy than the Shastres or the Koran.

Nor is there anything untrue or unscientific in the descriptions of nature as it really appears to our eyes, or is apprehended by our senses. That which we see of nature, however far short it may come of all that may be known concerning its interior properties, is yet an element of importance, and not unfrequently the synthesis to which scientific analysis directly leads. The language which describes things as they appear will always be true in fact, whatever may be the laws upon which such appearances depend. Back of these appearances there may, it is true, be whole regions of unimagined wonders which the unaided eye cannot see nor the ear hear, and which but for the steady and resistless march of scientific investigation would be all unknown to man. But the discovery of the unseen does not invalidate the truthfulness of that which is seen. This is still the visible outworks and magnificent portals of the kingdom of nature. Seeing therefore that it was not the purpose of the Creator to give revealed anticipations of nature, but to leave nature as a field for the exercise of human intelligence, we can conceive of no better form in which allusions could be made to nature in the Bible than that of a strict adherence to the language of appearances.

In the application of this principle to biblical interpretation we would, in terms slightly different from those of chapter third of "Archaia," in which the general views of nature contained in the Scriptures are noted, say:—1st. That Scripture represents nature as subject to invariable law, because such is the aspect in which it appears to the accurate observer;—2nd. That it represents nature as in constant progress and development, because such are the aspects in which it appears to ordinary perception;—3rd. That the Bible notes purpose, use, and special adaptations in nature, because such are apparent to sight and sense;—4th. That the law of type or pattern is just so far indicated in the Sacred Record, as it appears in the objects of nature themselves. All these are truths, from which science may start on its glorious mission of discovery into the veiled realms of creation.

Before proceeding to an examination of the exegetical part of "Archaia," we have yet to premise that in the objections we may take to its conclusion, we are not influenced by what its author quaintly styles a "pedantic hyperorthodoxy." Orthodox we profess to be in the highest and best sense of that term, but our orthodoxy has not yet led us to fear or tremble for the safety of our Ark. As regards the cosmical statements of Genesis we have always held ourselves free to accept of any light which might aid our understanding of them come from what quarter it may. We began our thinking on the subject with the rejection of the Cuvierian hypothesis of day-periods and a determination to keep by the old paths till more light dawned to guide us. We afterwards accepted the *first-verse* theory of the venerable Chalmers, fairly captivated under the influence of his commanding genius. Next, the powerful arm of Hugh Miller in his first Exeter Hall lecture came down upon us with such force as to shatter to pieces our former ideas, and constrain us to become his devoted disciple. At this we stood for many a day. But every time in the course of private reading that we came to the text in Genesis, we felt an uncomfortable consciousness of the insecurity of our position. We have since tried the theories of Pye Smith, Hitchcock and others, with an occasional attempt at an adjustment of our own. But the last expositions of Miller, together with a study of the profound views of Kurtz, has driven us to begin a new, inch by inch, investigation of the subject the results of which are conclusions somewhat different from those so ably stated by our author.

Instead of looking at the text in view of geological inductions and facts, or looking at geology with an eye on the sacred text, we have looked upon each by itself and interrogated each as to its contents. The one we have subjected to scrutiny on the principles of grammar and philology, the other on the principles of scientific induction. It appears to us that much rubbish has been accumulated upon the text from the region of the rocks; and much folly charged upon the rocks at the presumed instigation of the text. To avoid confusion we have examined each by itself as we would examine a witness in a criminal court, and having got as clearly as possible the testimonies of each we have considered their relative values, and whether they may not be capable of such an adjustment as to constitute them one whole and harmonious display of creative goodness, wisdom and power.

It is impossible for us to go over in detail within the compass of this review, the steps of this somewhat elaborate process. All that we can do is to indicate briefly the results at which we have arrived, and the points in regard to which we differ from the conclusions of our author.

Applying then our grammatical apparatus to the leading and important words of the text, we conclude:—1. That "the *Heaven*" (*hashamayim*) means the expanse (*rakiah*) bounded by the earth and the blue empyrean upon which the eye seems to rest its upward gaze. The idea of confining the created heaven to the atmosphere of science, or limiting its upward boundary by the clouds is we judge neither scientific nor grammatical. Science does not yet know the limits of the atmosphere, and its latest conjecture is that it is illimitable as space itself,—that the same atmosphere which circumambiates our globe enfolds with varying densities the whole planetary system in its ample bosom. Further, the clouds gave no definite limits to the atmosphere, their altitudes must vary many thousands of feet. And what shall we make of the firmament when the waters which it contains are so comminuted that no clouds at all intervene between the earth and the deep blue sky? The mistake of regarding the clouds as the upward shore of the firmament arises from interpreting the word "*waters*" in the sixth verse as meaning *clouds*. Now upon no grammatical principle of interpretation can this be admitted. It does not appear from the narrative that the prophet saw any clouds at all after the evaporation of the waters which covered the surface of the yet unformed world. Not during the

whole six days did any rain appear. A mist from the earth watered the whole face of the ground. What the prophet saw, and what he evidently describes in the creation of the expanse, is the vapour which hung over the waters rising up and dispersing itself into seemingly the clear sky. The statement of our author that in verse twenty the words "firmament of heaven" are two names of two things, the one the earth's atmosphere, the other the higher expanse in which the stars shine, is, we think not tenable, because:—1st. God called the firmament "*heaven*"; firmament and heaven in the verses following these words ought, therefore, to be regarded as strictly synonymous; 2nd. *Rekiah hashamayim* (firmament of heaven) are in what is termed the *status constructus*, or in the relation of one substantive governing another in the genitive. A similar expression would be the "height of the house," or the "length of the cord." In the first of the sentences "height" and "house" are not two separate things, but the one is limited by the other, and both are together one and the same thing. There is therefore no ground as we conceive to interpret the word "heaven" in any other sense than that of the optical expanse between the earth and the blue sky which is in fact the fountain of the waters that are above the earth. And for reasons which we shall note in relation to the word "earth," we hold that "the heavens" of the first verse means the same thing as "the heavens" of the eighth.

2. Earth (*aretz*). As regards this word we perfectly agree with the statement of "Archaia" in page 46, namely; "That in the tenth verse of Genesis there occurs a definition, as precise as that of any lexicon—"and God called the *dry land* earth." From these words our author thinks it a fair consequence "to assume that the earth, *afterwards* spoken of, is the dry land." If the word "afterwards" is here designed to cover the use of the term *everywhere*, and chronologically, after the time at which it was given to the dry land we would then consider the above application of the definition a perfectly correct one. But if "*afterwards*" is intended to limit the use of the term *earth* in the sense defined to the places in which it *subsequently* occurs in the text, thus leaving the word open to receive another meaning in those places in which it is *previously* used, we cannot then agree to the restriction. This last use is evidently the intention of our author, for, in page 6, he puts another meaning upon the word *earth* than the definition of verse tenth. He there makes the earth of the first verse to include

the "deep or the material from which the sea and atmosphere were afterwards formed." This, we think, an error into which our author has been led by the view he takes of the relation of the first verse to the whole narrative. That verse he considers as delineating the first step in the great work of creation. In page 61, he says: "The history opens at once with the assertion of a great fundamental truth,—the production from non-existence of the material universe by the eternal self-existent God." Now we are constrained to say with feelings of profoundest reverence for the text itself, that fascinating as the above doctrine may be, and nobly eloquent as the expressions are which our author, in page 339, has founded upon it, we yet cannot see that it directly expresses the doctrine of creation from non-existence which the above quotation alleges. In our view the *first* verse, but states in general terms that which the subsequent narrative gives in detail—that, in short, it is a brief prologue or proem. The conjunction "and" of the second verse does not present any grammatical hindrance to this idea, for there the *vav* (and) is, as Gesenius remarks "continuative of discourse." It indicates a consecution of sentences more than a relation of words. This consecutive use of *vav* is very remarkable in the whole of the narrative; it stands at the beginning of every verse but the first and in the twenty-sixth verse has been rendered "so" by our translators. There is therefore no grammatical reason why we may not regard the first verse as the proem of the sublime record of creation.

If further we look upon the first verse as an answer to the question: Whence came this earth and that heaven? What form of speech could be a more natural reply than that, "In the beginning, God made the heaven and the earth,"

Viewing the first verse in this relation, it cannot be alleged that the words "heaven and earth" are there used in a sense, different from that in which they are defined in the eight and tenth verses. The meaning of the verse would then be that God, in the beginning made this dry land and that expansion which were at first in a void and formless state. In this view the words succeeding the prologue will be the first step of the narrative in which the prophet describes the first aspect of those elements which by the power of the Divine Word, afterwards became "heavens and earth." If we, for example, were describing the process which, as geology informs us, stratified rock is formed, we would say that

the rock was in the beginning, "without form and void." But no one could infer from this statement that we gave the name "rock" to the yet unformed condition of its elements. So neither can we see why the words "heaven and earth" should be regarded as appellations of the unformed and chaotic condition of their elements.

3. Create. (*bara*). From the view taken of the words "heaven and earth" it will follow that the word "*bara*" is not used here to express the idea of absolute creation. There is nothing in the text requiring that it should be so understood. Nor does the use of the word in other places lead us to infer that it ever was so understood by the Hebrew writers. "*Bara*" and "*asah*" are constantly used in this narrative and in other places as convertible terms. Of this we have manifest instances in verses 21, 25, 26 and 27. In the first of these "*bara*" is used in reference to the creation of great whales, &c.; in the second "*asah*" is applied to the creation of the beasts of the earth; in the third "*asah*" is taken to describe the last and highest act of creation, when God said "Let us *make* man"; and in the fourth "*bara*" is used to designate the same creative act. No claim can therefore be established for "*bara*" as a word of wider signification than "*asah*," Both are constantly used to designate the act of making, forming or creating. We know of no biblical critic of modern times who, on grammatical grounds, will say that "*bara*" means the act of absolute creation out of nothing. All that the *usus loquendi* will authorise is that "*bara*" is most frequently used to express the highest exercise of divine power—that it is somewhat more intensive than its synonym "*asah*," and that it is seldom used in reference to the acts or works of man. Whatever *deductions* may be drawn from the statement of the first verse, as to the creation of the heavens and earth out of nothing, it is to us obvious that the literal grammatical rendering of the words will not yield such a sense. Nothing therefore hinders that this first verse should be the prologue or proem of the biblical account of the creation.

4. Day. (*vom*). This is the word upon which the scheme of our author mainly rests. The idea that it means a long period was first started by Cuvier, and has since been adopted by Jameson, Miller and others. In chapter seventh of this book the subject is elaborately and ingeniously argued, and it would require more space than we can command to reply to all the statements

which it contains. Much of the reasoning is based on the supposition that the chief words of the narrative are used in different senses in different places. We have shown that in regard to three of the most prominent that such is by no means the case, nor can we think that this word "*yom*" is used in any other than one and the same signification throughout. In verse *fourth* it is stated that not till the light was definitely divided from the darkness did God on the fifth day call the "light day" and the "darkness night." Now just let us take our authors admirable explanations of the separation of the light from the darkness, and consider the conclusion to which it leads us. In page 89, he says: "To explain the division of the light from the darkness we need only suppose that the luminous matter in the progress of its concentration was, at length, all gathered within the earth's orbit, and then, as one hemisphere only will be illuminated at a time, the separation of light from darkness or of day from night would be established. This hypothesis suggested by the words themselves affords a simple and natural explanation of a statement otherwise obscure." If to this we add the diurnal revolution of the earth upon its own axis which on the hypothesis of Laplace, or any other, must have been established at this early time, we have then in the concentration of luminous matter within the earth's orbit, together with the earth's own revolution, all the elements to establish a *natural* day even before the creation of the Sun; and under such conditions the *first* day could not have been materially different from that of the *fourth.*

Besides this, the character of the light which was called "*day*" is precisely defined when it is said to have been an "*evening*" and a "*morning.*" Before the light was divided from the darkness, or was called day, this definition of its periodical duration is not given, but after this event the period of light is marked out by the distinct boundaries of "*evening* and *morning.*" This evening and morning defines therefore diurnal light with minute precision, and is that which the Creator calls "day" and of which it is said "Are there not twelve hours in the day?"

We have ever regarded the attempt to make "evening and morning" in the text mean the civil day of 24 hours as altogether futile. The position of the word *evening* before that of *morning* is not wonderful if we consider the language to be descriptive of the impression which the close of such a sublime vision would make upon the mind of the prophet. Let, for example, a splendid

panorama pass before the eyes of a wondering multitude, and it will be found that the closing scene will be that which was most vividly impressed upon their minds.

The last scene of the several creative acts, recorded in Genesis, is therefore not unnaturally that which is recorded first : " The evening was and the morning was ONE day." We cannot agree therefore with our author that the word "day" (*yom*) " occurs in two senses (in the narrative) and that while it was to be the popular and proper term for the natural day, this sense must be distinguished from its other meaning as a day of creation." Nor can we regard the affixing of the name "*day*" to the light " as a plain and authoritive declaration *that the day of creation is not the day of popular speech.*" (p. 100.)

If we were so to regard the day (*yom*) of the text, then we would be driven to regard the " day of creation" as a long, even an illimitable period, of light; for nothing can be more clear than that only light bounded by evening and morning is *day*. On the other hand we would also be compelled to suppose that this *long long* day-light was followed by an equally long night-darkness, and that there was a succession of such days and nights during the whole six periods of creation.

What, in such a case, would become of the diurnal motion of the earth and even of the powers and purposes of the Sun himself? Unless to a geologist and an allegorical interpreter, we believe the *idea* that the word "*yom*" of the text, designates a period comprising, it may be, myriads of years, would never have been conceived. That the learned Origen, in the year 220 A.D., entertained some such an idea, was the result of his oriental culture, under the influence of which he attempted to make the creation, fall and deluge, a grand allegory which, if he had succeeded in doing, would have swept away the foundations of the Christian faith. As we reject his allegory of the fall so we reject his allegory of the days.

Nor do we consider any support to the day-period theory to be derived from the confessions of St. Augustine, a learned, but by no means critical writer of the 5th century, in which he speaks charmingly of the dispensation of grace being the Sabbath-day of the Lord, and the work of his rest as that of human redemption. That these are fine thoughts every christian will allow. So pleasing have they been that they have floated in christian literature from a very early date down to the present time. They originated doubtless from the fact that God is represented as ending his

material creation on our planet on the sixth day, the inference is that God still rests. Notwithstanding the weight of Hugh Millar's arguments on this point, and the decided terms in which he insists that our Sabbath is a day proportional to the Sabbath of the Lord, we yet see no scriptural warrant for such an idea. More likely to our mind is that to have been the Sabbath of the Lord, when in the garden of Eden he walked with the perfect and unfallen man, and rested with holy complacency in the glory of his finished work. Here we have that which perfectly accords with the idea of Divine rest, and which constitutes sinless Paradise the most expressive emblem of that eternal rest prepared for the children of God.

The period of human redemption in which there is, as its most prominent feature, the sufferings and death of the Saviour is to our thinking a time in which there is more of Divine *working*, more signal displays of divine power, than in all the works of material creation. It was concerning this redemption period that Christ said: "My Father worketh hitherto and I work." These considerations do not well comport with the idea that the dispensation of grace is the Sabbath period of the Lord. A careful consideration of the text conveys to us the idea that the Sabbath on which Gcd is *represented* as resting from all his works is the literal diurnal seventh day following in regular succession that which by way of emphasis is marked with the cardinal "ONE" and in which the perfect holiness of the world was undisturbed by sin.

That the words "in the day" (*beyom*) are used in chapter ii. 4, in a sense different from that in which day (*yom*) is used in the first chapter does not in the least affect our conclusion. The sentence in which "in the day" (*beyom*) is found is obviously a parallel to the first clause of the same verse which says. "These are the generations of the heavens and the earth *when* they were created." It thus appears that, "when" and "in the day" are used to mean one and the same thing; the one in fact according to the well ascertained principles of Hebrew grammar exactly explains the meaning of the other. In the chrestomathy of the scholarly and accurate Nordheimer the words "in the day" (*beyom*) are rendered by the phrase "during the time."

That such an adverbial form of "*yom*" in composition with the preposition "*beth*" was in use at this early time, the text itself is evidence sufficient. At the time the narrative was written the Hebrew language had already attained its classic fullness and

precision. That the particular and the general, the concrete and the abstract use of words have been well understood from the earliest times is exemplified in all the most ancient writings. The Hebrew, Greek, and Latin tongues abound with instances in point and in our own speech these forms are as familiar as day. Such a use is founded upon the principles of thought which are antecedent to the forms of speech. In the mind's synthetic moods it rises from particulars to generals and in its corresponding analytic it descends from the general to the particular.

But even if contrary to all good criticism "*beyom*" (in-the-day) were to be understood as a substantive and not as an adverbial form of speech, and as describing a period of time, this would not invalidate our interpretation of the *yom*" (day) of the first chapter. "*Beyom*" (in-the-day) would then only stand in relation to "*yom*" (day) as a genus to a species, and its own meaning would come to be determined by the idea attached to the species which it includes, if, therefore, "day" (*yom*) was truly a long period then "in-the-day" (*beyom*) would be a period inclusive of all the day-periods, but if "day" was truly a diurnal and natural day then "in-the-day" would simply represent the time of six such days. No argument for the day-period hypothesis can therefore as we conceive be founded on the word "*beyom*" in Genesis ii. 4.

We have thus in as limited a space as possible gone over the leading words in the narrative of creation; and without attempting to answer objections or adduce all the arguments and illustrations which we might we have endeavoured to defend on grammatical and philological principles the literal rendering of the words in Genesis first, as also the one-sense in which they are used throughout. The conclusion to which we have come is that the language of the first chapter cannot be used in any other than the literal sense without altogether upsetting the well established principles upon which language is to be interpreted.

According to our plan we would now consider what the facts and acknowledged inductions of geological science teach us regarding the *formation* of the world.

Geology informs us that on a rough estimate the average thickness of the earth's crust is about fifteen miles. In this is included a considerable thickness of what for want of a better name may be called primitive rocks, regarding the formation of which geology can tell us little or nothing. Whence they came or how formed is a problem yet to be solved. They contain no distinct remains of organic

life. Their occasional veins of graphite or bands of crystaline limestone afford but doubtful evidence of their having once been stratified or that they were the habitat of animal and vegetable life. To the strata superimposed upon these primitive rocks geology points us for its evidence of the way in which the earth's crust has been formed and as indices of the time that has elapsed during its formation. These stratified rocks have been divided into three great periods,—the Palœozoic or most ancient, the Mezozoic or middle and the Cainozoic or latest. These divisions are again subdivided into numerous minor strata each determined and in some sense seperated from the others by its peculiar organic remains. These strata are shown to be either the result of vegetation, as in the coal measures, or of animal life, as in the Silurian and other rocks, or of aqueous deposition. These three forces if we may so speak have been the agencies by which the earth's crust has been mainly formed. Now to any one who can form an idea of the succession of organic life, the remains of which these strata contain, and of the slow action of aqueous depositions it must be obvious that the crust of the earth is of immense antiquity—that from the period of the earliest Silurian seas up to the recent stratum upon which man dwells, there is the unquestionable lapse of countless ages. This is one of the certain inductions of geology concerning which there can scarcely be any dispute.

It is a further fact than in these strata we find evidences of a constant succession of animal and vegetable life.

First, there is a long period, the Silurian, in which the lower forms of marine animal life vastly predominate and in which but few traces of vegetable life are found and these exclusively marine or Algoid ?

A second step leads us into a region in which there is added to the invertebrate life of the first a large and magnificent group of Ganoid vertebrate fishes with some forms of the higher land plants recently discovered by Principal Dawson.

By a third step upwards we reach the great carboniferous or coal measures, in which we find a thickness of about 10,000 feet of fluvio-marine strata and for the first time a predominance of land plants, comprising the two lower members of the vegetable kingdom—the cryptogamic and gymospermic plants. Here also we are introduced to the oldest known reptiles, the discovery of which is in a great measure due to Principal Dawson.

A fourth step brings us among the great Batrachian reptiles

and if in this step we include the whole secondary or Mezozoic period we have multitudes of great Saurians :

"Hydras and Gorgons and Chimeras dire."

With these we find allied in the vegetable kingdom, Conifers, Cycads and Ferns. Here too we first discover the lowest forms of Mammals in the Stonesfield and Purbeck marsupials.

A fifth step brings us to the highest developed forms of both plants and animals,—to genera and species in all the departments of organic life nearly allied to those existing at present.

A last and final step brings us to the remains of our present fauna and flora with those of recently extinct species, superimposed upon which we find human remains and works of act.

These six steps indicate a gradual progression in creation from lower to higher forms of organic life. In the vegetable kingdom we rise from the lowest Thallogens up to the highest forms of Exogens and in the Animal from the Protozoa up to the highest Mammal—MAN.

These steps also indicate certain epochs of life,—certain periods in which peculiar forms of life were predominant. 1. A Silurian period of Marine Molluscus and Radiate life. 2. A Devonian period of Vertebrate fish life. 3. A carboniferous period of vegetable Cryptogamic life. 4. A Mezozoic period of great Batrachian serpent life. 5. A tertiary period of monster Mammal life, to which there is closely allied, the genera and species of the present day.

These steps further indicate with a fullness and certainty of illustration that there has been a gradual disappearance of old species and a continuous creation of new up to the age of man. Along with well marked epochs of creation of special forms of life there has been a much more marked continuity of creation in all the forms of organic life. If we could suppose the period of special creation to be represented by horizontal lines placed at wide intervals then the facts of continuous creation might be represented by vertical lines crossing the others continuously up to the introduction of man. It was at first supposed by geologists, as may be seen in the writing of Hugh Miliar, that there were great breaks or chasms in the upward lines of organic creation ; that at several of its stages certain chaotic periods intervened and cut off forms of life above from forms of life below; but the more recent discoveries have shown this view to be quite untenable. Gaps have been filled up and those that remain are in process of yielding up their links of organic forms.

It is true that in this upward series of creation we do not find all the lines of life to begin at the same time. The lines of lower life are first. In the vegetable kingdom the order is: Thallogens Acrogens, Gymnogens, Exogens. But these lines when once severally begun are carried up to the close by the creation of new species in each, the whole bursting forth in our present magnificent flora. Again, in the Animal Kingdom the order of the lines is: Molluscus, Radiata, Articulata, Vertebrata. In each of these sub-kingdoms the generic and specific lines of creation increase in number as they ascend and in the human period emerge in a magnificent procession of animal life the leader and lord of which is MAN.

Although our author does not give much prominence to this phase of continuous creation observed in the geological record, he yet affords ample evidence of its truth. For this we would refer the reader to pages 116, 335 to 337 and to Appendix F, page 370. Reference may also be made to the 14th chapter of "Agassiz and Gould's Principles of Zoology."

From this sketch of geological facts we think that the periods of life revealed by the rocks do not correspond with our author's scientific interpretation of the day-periods of Genesis. Upon no scientific principle can it be said that we have in geology *first* the creation of plants and then in two stages or periods the creation of animals. To make geology agree with the day-period hypothesis it would require to be shown that all the plants were created at one period, all the fishes, birds, batrachians and serpents at another; all the mammals at a third, and all too in regular succession. Now we maintain that geological science can, upon no scientific arrangement of its materials, be made to yield such results. No advantage is therefore gained by interpreting the "day" of Genesis in the non-natural sense of a long period; for even then the long periods of the record will not agree with the long periods of the rocks.

In these circumstances we must therefore come to one of two conclusions:

1st, That geology has not yet reached that stage at which its inductions or results can be regarded as sufficiently determined or final as to permit their adjustment with the statements of the sacred record. This is the position which unscientific theologians and critics are very apt to assume. They consequently say to the geologists "agree as to the final inductions of your science, tell us when you have reached the limits of your discoveries, then, come

to us and we will compare your work with the Scripture text." With thus view we have little sympathy. It can only be regarded as a decent refuge for scientific ignorance. The theologian and the critic are bound for themselves to discover what the works as well as the words of God say, and to teach the truth of both combined. They are the persons to whom the world will look for an adjustment of the two records, and the sooner they set about it the better, not in the way of guessing but in that of logical and scientific determination. Geology is we believe in a sufficiently advanced state to afford at least an approximate settlement of the vext question.

2. A second conclusion is, that there is a method of adjustment which does violence neither to the grammatical meaning and structure of the sacred text, nor to the well ascertained results of geological science. This method is to be found in the *form* of the record itself. If instead of regarding it as a verbal revelation, we regarded it in the light of a series of day-visions by which God revealed to his prophet the great leading facts in the past history of the world, many difficulties otherwise insurmountable will then disappear. The text may then be accepted in its most literal sense, and every description of natural phenomena be taken as the language of appearances. The Creator will then, as in other parts of Scripture, be said to do that which without reference either to time or to second causes he appears to do. In this view the text does not require us to believe that God literally created and made all things in six natural days, but only that in a series of natural day visions, there was exhibited, as well as could be to human eyes, the vast and wonderful processes and progress of creation.

Accepting the facts of geology as presenting to us both special epochs and continuous acts of creation, or, according to our illustration, interrupted horizontal, and continuous vertical lines of creation up to the human period, the question is how could this vast panorama and evolution of things be, for moral purposes, presented to unscientific human eyes? We can conceive of no better form than that which we find in the text. It contains a sufficient agreement with the facts to show that only He who knew the one could pourtray the other. The text wonderfully comprises in its divine generalizations all the facts yet discovered in the rocks, and in its typical forms represents the great leading epochs of organic life, of which we have a history in the rocks.

It represents too that order of progression from lower to higher conditions of the world, and of its tribes of organic life. These things lay quite beyond the reach of early human knowledge and the precision with which they are stated indicates that the narrative is vastly more than guesses at truth or anticipations of natural science.

The view which we have thus taken of scriptural cosmogony is that to which the learned writings of Kurtz has led the way—it is that, too, which in some of its features has been so grandly stated by Hugh Miller in his "Testimony of the Rocks." In some of its details it agrees with the views of Sime in his little work entitled "The Mosaic Record in harmony with the Geological." Whatever aid has been derived from these and other works, we have yet in our criticism followed an independent line of investigation, and presented views both of the text and of geology, which to us are somewhat new.

Space will not permit us further to enlarge on the other topics of deep interest to be found in "Archaia." We can only say that the second part of the book which treats of the unity of the human race and ably discusses the difficult questions which it involves, is worthy of attentive perusal. In this department our author is rather in advance of the naturalists of the present period. His treatment of the whole subject exhibits a ripeness of thought, clearness and acuteness of perception together with a sobriety of judgment, not often to be found in writers upon the discursive topics of ethnology. To those who wish to become acquainted with the present condition of ethnological science, we can recommend nothing better than the chapters which pertain to it in Dr. Dawson's book.

We cannot but commend the publishers for the enterprise and spirit which they manifest in the publication of this volume. It is well got up, and if not quite so good as can be produced in Eng-and, it is yet equal to anything of the kind on this continent. It can be read with comfort, and altogether it is a handsome book. We trust that the reading public will show their appreciation of this native production—it is all Canadian—by the speedy purchase of the entire edition.

A. F. K.

MISCELLANEOUS.

A Systematic List of Coleoptera found iu the Vicinity of Montreal. By W. S. M. D'URBAIN.

(*Continued from page* 320.)

III. *Lamiæ*, Lec.

(See Journ. Acad. Nat. Sci. Phila., Vol. II., second series, p. 139.)

1. Fam. *Lamiidæ*, Newm.

1. Monohammus, *Serv.* (Monochamus, *Kirby.*)
   M. scutellatus, *Say.* (resutor, *Kirby.*) Abundant everywhere, June to August.
   M. confusor, *Kirby.* Abundant about woodyards, July and August.
2. Saperda, *Fabr.*
   S. calcarata, *Hald.* Rare.
   S. vestita, *Say.* Not very common.
   S. mœsta, *Lec.* Very rare. Taken by sweeping grass on the Mountain, June.
   S. tridentata, *Oliv.* Not common, June to August.
3. Leptostylus, *Lec.*
   L. aculiferus, *Say.* One specimen taken under a stone on the Mountain, April 19th, 1858.
4. Graphisurus, *Kirby.*
   G. fasciatus, *Geer.* Not common, Montreal and Sorel.

PHYTOPHAGA.

1. Fam. *Crioceridæ*, Leach.

1. Donacia, *Fabr.* (See Proc. Acad. Nat. Sci. Phila., Vol. V p. 310.
   D. lucida, *Lac.* On aquatic plants, July.
2. Lema, *Fabr.*
   L. trilineata, *Oliv.* Very abundant on potatoe-vines, August.

2. Fam. *Cassididæ*, Westw.

1. Cassida, *Herbst.*
   C. unipunctata, *Say.* Abundant.
2. Chelymorpha, *Chevr.*
   C. cribaria, *Fabr.* Abundant on leaves of the Minor Convolvulus in gardens Montreal and Sorel.
3. Hispa, *Linn.*
   H. quadrata, *Fabr.* Rare, ou thorn-blossoms, June.

3. Fam. *Galerucidæ*, Steph.

1. Galeruca, *Geoff.*
   G. baccharides? *Fabr.* Very numerous on flowers of *Solidago* and of umbelliferous plants, July and August.
   G. Americana? *Fabr.* Swept from herbage on the Mountain, June 1857.

2. Cerotoma, *Chevr.*
   C. caminea, *Fabr.* By sweeping herbage on the Mountain, June 1857.
3. Diabrotica. *Chevr.*
   D. vittata, *Fabr.* Very abundant on melon and cucumber vines, June to October.
4. Haltica, *Illig.*
   H. alni, *Harris MSS.* In vast numbers on alder-bushes on the common at Laprairie, September.
   H. splendida, *Dej. Cat.* Very abundant on grape-vines, June.
   H. collaris, *Fabr.* Rare.
   H. frontalis, *Fabr.* Abundant in heads of Thistles, July and August.
   H. pubescens, *Erichs.* Very abundant by sweeping grass, June.
   H. striolata, *Illig.* Very abundant, May and Jnne.
5. Psylliodes, *Latr.*
   P. punctulata, *Mels.* By sweeping grass, Logan's farm, June.
6. Dibolia, *Satr.*
   D. ærea, *Mels.* By sweeping herbage on the Mountain, June.

4. Fam. *Chrysomelidæ*, Leach.

1. Heteraspis, *Dej.*
   H. curtipennis ? *Mels*, Swept from herbage on the Mountain, June.
2. Bromius, *Cherv.*
   B. vitis, *Fabr.* May.
3. Doryphora, *Fabr.* (See Proc. Acad. Nat. Sci. Phila., Vol. VIII. p. 30.)
   D. trimaculata, *Fabr.* Abundant on the milkweed (*Asclepias cornuti*), June and July.
4. Chrysomela, *Linn.* (See Proc. Acad. Nat. Sci. Phila., Vol. VIII. p. 32.)
   C. scalaris, *Lec.* Abundant.
   C. Philadelpeica, *Linn.* Abundant on Willows, June and July.
   C. Bigsbyana, *Kirby.* Not so numerous as the last species.
   C. (*Helodes*) trivittata, *Say.* Very abundant by sweeping grass, June.
   C. (*Phædon*) polygoni, *Linn.* (cæruleipennis, *Say.*) Very abundant on *Polygonum ariculare* (knot-grass) in waste places.
5. Chryrochus, *Cherv.*
   C. auratus, *Fabr.* Abundant on dogsbane (*Apocynum androsemifolium*), July.
6. Chalcophana.
   C. picipes. On elm-leaves; not very common. (Abundant at Sorel.)

PSEUDOTRIMERA.

1. Fam. *Endomychidæ*, Leach.

(See Proc. Acad. Nat. Sci. Phila., Vol. VI. p. 357.)

1. **Endomychidæ**, *Leach.*

E. biguttatus, *Say.* Abundant under bark of stumps on the Mountain and Mile-end road.

2. Fam. *Coccinellidæ*, Leach.

(See Proc. Acad. Nat. Sci. Phila., Vol. VI. p. 129.)

1. Brachyacantha, *Mulsant.*
   - B. ursina, *Fabr.* Abundant on milkweed (*Asclepias cornuti*), July.
   - B. 10-pustulata, *Mels* Rare, on flowers of umbelliferous plants on the Mountain, July.
2. Chilocorus, *Leach.*
   - C. bivulnerus, *Mels.* Common on the bark of the white birch, Laprairie, in October.
3. Psyllobora, *Mulsant.*
   - P. 20-maculata, *Say.* Abundant by sweeping herbage on the Mountain, June.
4. Hippodamia, *Mulsant.*
   - H. 13-punctata, *Linn.* Common, June and July, Montreal and Sorel.
   - H. quinque-signata, *Kirby.* Abundant on potatoe-vines, St. Hilaire, end of August.
5. Coccinella, *Linn.*
   - C. ophthalmica, *Muls.* Rare, June.
   - C. bipunctata, *Linn.* Very abundant everywhere.
   - C. novemnotata, *Herbst.* Abundant.

Note.—The Journal and the Proceedings of the Academy of Natural Sciences of Philadelphia contain numerous elaborate monographs by Dr. Leconte on various families and genera of North American Coleoptera, and, for the convenience of those wishing to name their collections, I have supplied references to them.

The following species which I have taken at Sorel, I have not yet met with near Montreal:

Platynus lutulentus, *Lec.* Under dry cow-dung, May.
" picipennis, *Kirby.* " " "
Anisodactylus rusticus, *Say.* " " " very abundant.
Agathidium exiguum, *Mels.* Under bark of dead pine-stumps.
Platysoma paralellum, *Say.* " " "
Ancylocheira fasciata, *Fabr.* Common, July.
Elater phænicopterus, *Germ.* Var. Under bark of dead pine stumps.
Lytta Fabricii, *Lec.* (cinerea, *Fabr.*) In great numbers on potatoe-vines.
Hypophlæus nitidus, *Mels.* Under bark of a dead pine-stump.

Montreal, June 2nd, 1859.

INDEX.

MONTHLY METEOROLOGICAL REGISTER, ST. MARTINS, ISLE JESUS, CANADA EAST, (NINE MILES WEST OF MONTREAL,) FOR THE MONTH OF OCTOBER, 1859.

Latitude, 45 degrees 32 minutes North. Longitude, 73 degrees 36 minutes West. Height above the level of the Sea, 118 feet.

BY CHARLES SMALLWOOD, M.D., LL.D.

Day of Month.	Barometer, corrected and reduced to 32° F. (English inches.)			Temperature of the Air. F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Mean Velocity in Miles per hour.			Amo'nt of Rain in inches.	Amo'nt of Snow in inches.	Weather, Clouds, Remarks, &c. &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.			6 a. m.	2 p. m.	10 p. m.
1	29 894	29 75[illegible]	29 786	50 6	60 4	55 7	328	457	405	89	94	94	S.	S. by W.	S. W	0 46	0 76	2 16	0 187		Rain.	Rain.	Cu. Str. 9.
2	642	525	610	51 1	52 3	47 2	348	375	298	93	93	92	S. S. W.	S. by W.	W. by S.	2 35	10 22	8 11	0 556		Clear.	Cu. Str. 8.	Str. 4. Aurora Borealis.
3	800	701	620	40 3	52 9	51 6	208	354	321	82	90	86	W. S. W.	S. W.	S. W.	15 81	12 27	6 30			"	" 10.	Cu. Str. 2.
4	584	686	807	54 8	71 1	65 8	362	544	345	87	73	80	S. W.	W.	E.	1 53	7 61	1 48			"	Clear.	Clear.
5	748	613	520	45.1	79 2	67 2	.275	574	362	92	58	89	N. E.	S. W. by W.	W. S. W.	4 51	1 50	7 53			"	"	C. Str. 3. Distant Lightning.
6	722	635	764	41 9	48 6	40 0	.197	165	188	78	43	77	W. by S.	W. by N.	W.	10 48	3 45	15 02	In[illegible]p		Rain.	C. C. Str. 6.	Clear.
7	776	758	846	34 1	50 2	42 0	.175	.309	184	89	85	70	S. W.	W. by S.	W.	7 51	7 12	0 11			Clear.	C. Str. 4.	Cu. Str. 4.
8	900	851	916	30 6	48 7	36 2	130	165	170	78	49	80	N. by W.	E. S. E.	N. E. by E.	0 06	1 43	0 51			Cu. Str. 6.	Clear.	[illegible] C. Str. 9. Lunar Halo.
9	30 005	30 006	30 129	34 0	51 0	36 3	126	.123	170	65	50	80	N. E.	N. N. W.	S. S. E.	7 13	13 70	1 52			Clear.	"	Clear.
10	060	29 942	29 963	28 9	55 1	40 9	111	168	197	71	39	78	N. N. E.	W. by S.	S. by W.	0 06	1 00	1 73			"	"	"
11	29 920	907	30 065	39 4	60 1	40 3	216	338	182	91	45	73	S. W. by W.	W. S. W.	W. N. W.	16 01	0 62	0 63			"	Cu. Str. 3.	"
12	30 150	30 082	29 984	31 1	56 1	41 9	.185	.211	206	89	48	78	N. N. W.	S. W.	S. by E.	0 83	1 17	1 48			"	Cirri 2.	Clear. Lunar Halo.
13	29 780	29 668	622	42 7	68 8	62 9	247	443	392	87	65	60	S. S. E.	S. W.	S. W.	3 03	5 73	4 33			C. C. Str. 8.	C. C. Str. 8.	Rain.
14	514	466	562	51 5	59 7	40 8	241	.323	290	59	68	82	S. W.	W. S. W.	W. S. W.	14 00	22 60	2 11	[illegible]		[illegible] 10.	Cu. Str 4.	Cu. Str. 10.
15	694	739	940	24 2	51 2	32 1	169	256	143	84	61	79	N. N. E.	N. W.	N. W.	0 93	5 57	17 21			Sleet.	" 4.	Clear.
16	30 134	30 148	977	25 7	43 0	37 8	111	137	131	81	48	67	W. by N.	S. W. by W.	S. S. W.	3 35	12 86	0 71			Clear.	" 8.	Cu. Str. 2.
17	29 901	29 806	708	36 2	59 4	52 1	181	236	282	87	59	73	S. E. by E.	S. S. W.	S. S. W	0 10	0 57	0 01			Str. 2.	" 10.	C. Str. 10.
18	405	241	419	50 2	57 0	38 [illegible]	.335	.413	201	93	77	86	S.	W. S. W.	S. W.	0 21	1 10	11 45	0 580		C. Str. 10.	" 10.	Clear. Aurora Borealis.
19	654	669	700	31 0	44 6	32 2	130	189	.107	74	64	56	W. N. W.	W. N. W.	N. W.	11 61	21 23	32 61			Clear	" 4.	Str. 4. Aurora Borealis.
20	510	500	601	29 8	35 0	29 0	[illegible]	162	123	83	80	77	W. N. W.	W. by N.	W. N. W.	19 00	26 81	14 31		0 70	Cu. Str. 10.	" 10.	Snow.
21	487	484	520	24 2	30 5	28 2	.110	142	135	87	84	86	W. N. W.	W. by N	W. by N.	27 00	17 17	8 00		2 30	Snow.	Snow.	Snow.
22	564	571	701	30 0	42 9	34 1	[illegible]	209	175	83	78	89	W. by N.	W. by N.	W. S. W.	5 68	15 26	3 41			Cu. Str. 10.	Str. 4.	Str. 2. Faint Aurora Borealis.
23	781	799	870	30 0	45, 0	38 2	[illegible]	101	186	84	34	81	W. S. W.	W. S. W.	W. by S.	1 35	6 80	9 52			C. C. Str. 6.	Clear.	C. Str. 10.
24	774	710	760	30 2	40, 2	29 5	[illegible]	160	128	82	64	77	S. S. W.	W. N. W.	N. E. by E	0 00	11 02	8 61	Inapp.		" 10.	C. Str. 8.	" 4.
25	764	650	617	21 1	31 8	25 0	[illegible]	130	094	73	74	68	S. E.	W.	W. N. W.	3 35	0 70	16 21		Inapp.	Cirri Str. 4.	" 10.	Snow.
26	674	450	480	21 0	32 0	27 2	[illegible]	119	111	63	64	78	W. N. W.	W. N. W	W.	6 90	12 30	8 60			Clear.	" 2.	Cu. Str. 4.
27	254	251	320	23 9	33 2	32 2	[illegible]	131	143	72	70	79	W. by N.	W. N. W.	W.	10 16	1 60	13 36			C. C. Str. 4.	" 10.	" 10.
28	351	397	574	34 1	39 1	31 2	[illegible]	178	149	79	73	84	W.	W.	W. by N.	19 23	14 50	[illegible]			Cu. Str. 6.	" 10.	Clear.
29	680	710	860	31 5	41 0	36 1	[illegible]	147	177	78	57	85	W. N. W.	W. N. W.	N. W.	7 96	14 41	10 82			" 8.	" 6.	C. Str. 9.
30	900	807	926	32 6	41 9	36 2	156	190	170	85	74	80	W. by N.	W. by N.	W. S. W.	8 02	2 32	6 20			" 8.	" 4.	" 10.
31	900	874	960	31.6	38 9	34 1	.139	180	158	84	77	79	W. N. W.	W. N. W.	W.	0 56	11 40	2 47			" 10.	" 6.	" 10.

REPORT FOR THE MONTH OF NOVEMBER, 1859.

Day	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.			6 a. m.	2 p. m.	10 p. m.
1	30 004	29 901	29 924	32 0	41 0	38 1	142	190	186	84	74	81	S. W.	S. S. W.	S. W.	0 36	1 03	4 05			Cu. Str. 9.	Cu. Str. 10.	Cu. Str. 10.
2	29 870	864	850	30 4	46 2	33 3	[illegible]	[illegible]	108	90	77	89	S. W. S. W.	S. W	E. by S.	5 25	3 12	0 90	Inapp.		" 10.	" 2.	Str. 10.
3	30 124	30 240	30 301	28 1	[illegible]	21 2	117	.126	.094	76	75	73	N. W.	N. W	N. E. by E.	4 80	7 96	20 42		0 53	" 10.	" 4.	Cirri 4.
4	312	29 925	29 970	30 5	52 1	34 6	.142	162	177	83	89	91	S. S. E.	E. N. E.	E. N. E.	1 53	6 36	3 11	0 297	1 80	Snow.	Rain.	Regular.
5	29 820	768	951	31 0	54 3	42 0	155	190	177	89	97	66	E. S. E.	S. E.	W. N. W	11 05	0 00	5 10	Inapp.		Cu. Str. 10.	Cu. Str. 10.	Clear. Distant thunder at noon.
6	30 374	30 382	30 454	26 1	37 0	26 2	099	157	094	69	70	65	W. N. W.	W. N. W.	W.	17 95	3 42	1 05			Clear.	Clear.	Clear.
7	439	324	270	22 0	31 2	28 1	.084	.125	[illegible]	71	69	88	E.	N. E. by E.	N. E. by E	2 31	4 27	9 16			Cu. Str. 10.	C. C. Str. 10.	Cu. Str. 10.
8	183	009	042	30 0	52 5	36 0	148	[illegible]	191	88	66	89	E.	W.	S.	6 43	0 20	0 52			" 8.	Hazy	Hazy. Lunar Halo at 8 p. m.
9	29 901	29 804	29 824	30 0	52 2	47 5	114	304	290	70	76	82	S. E. by E.	W.	S. S. W.	0 21	0 57	3 80	0 100		Hazy.	Cu. Str. 10.	Rain.
10	800	521	499	31 0	33 7	30 2	.182	.182	154	95	94	94	N. E. by E.	N. E. by E	N. E. by E	15 90	8 30	20 91	0 6[illegible]0		Rain.	Regular.	C. Str. 10.
11	634	484	30 100	24 0	31 9	19 2	100	142	087	79	80	85	N. W.	N. W. by W	N. E. by E.	14 15	8 02	0 00		0 70	Cu. Str. 10.	Cu. Str. 4.	Clear.
12	30 114	701	29 600	20 0	32 1	33 4	[illegible]	113	184	85	79	96	N. E. by E.	N. E by E.	N. E. by E.	4 00	7 05	5 51		3 70	Clear.	Snow	Rain.
13	29 2[illegible]0	180	220	33 0	34 9	31 2	174	190	112	94	95	84	N. E. by E.	S. W.	W. S. W.	4 75	2 77	18 57	2 157		Rain	Cu. Str. 9.	C. Str. 2.
14	[illegible]	520	827	24 0	30 1	22 1	111	130	084	87	78	86	S. S. W.	W. S. W.	W. S. W.	24 70	1 52	23 88			C. Str. 2.	" 2.	Clear.
15	30 152	30 220	30 317	17 0	24 0	21 0	068	089	087	75	72	78	N. E. by E.	E. N. E.	S. E.	0 82	1 28	0 00			" 10.	" 10.	C. C. 9.
16	344	260	250	16 0	28 2	22 3	065	129	105	74	82	79	N. E. by E.	N. E. by E.	N. E. by E	6 41	4 02	4 72			C. C. 9.	Clear.	Clear.
17	081	048	090	30 1	49 1	12 2	.136	278	206	84	81	78	S. E.	S. E.	E. S. E.	0 81	2 00	8 24			Cu. Str. 9.	Cu. Str. 9.	Cu. Str. 10.
18	092	29 952	29 980	40 0	54 5	42 5	210	.328	244	86	77	91	E. S. E.	S. E. by E	N. E. by E	2 87	0 08	0 88	0 262		C. C. Str. 9.	" 10.	" 10.
19	29 611	465	219	41 4	42 3	40 6	251	261	241	96	98	96	N. E. by E.	N. E. by E.	N. E. by E.	4 72	15 60	9 81	3 746		Rain.	Rain.	" 10.
20	700	901	30 2[illegible]2	28 2	27 1	20 1	241	063	075	98	68	72	W.	N. W. by N.	N.	26 56	11 63	14 91	0 630	Inapp.	Cu. Str. 10.	Cu. Str. 9.	" 8.
21	30 4[illegible]5	30 301	224	16 3	25 0	23 2	074	100	.186	85	74	86	N. E. by E.	N. E. by E.	N. E. by E.	7 22	6 35	6 21			" 9.	" 4.	" 10.
22	29 904	29 840	29 750	23 1	32 9	31 4	107	.168	168	87	89	96	N. E. by E.	N. E. by E.	N. E. by E.	21 66	7 20	6 90		4 10	Snow.	Snow.	Snow.
23	842	969	30 054	25 2	31 0	25 2	113	161	129	84	85	98	W.	S. W.	W. S. W.	7 80	2 01	8 93		2 70	"	Snow.	Snow.
24	30 254	30 270	578	22 2	26 9	17 3	102	117	117	98	82	67	S. W.	W. S. W.	W. S. W.	9 86	6 66	6 00		0 50	"	Cu. Str. 10.	Clear.
25	315	224	29 910	7 1	22 4	21 5	012	079	196	66	68	88	W. S. W.	E. by N.	N. E. by E.	4 04	0 36	6 63		1 40	Clear.	" 10.	Snow.
26	29 214	29 162	464	34 2	42 0	31 8	190	199	162	95	74	89	N. E. by E.	S. by W.	S. W.	15 44	10 31	13 00			Snow.	" 8.	Cu. Str. 6.
27	661	679	600	30 6	35 6	30 0	148	162	154	88	84	89	S. W.	S. W.	S. S. E.	2 80	0 08	2 23			Cu. Str. 4.	" 10.	Clear.
28	678	720	657	21 1	27. 4	27 1	080	105	126	74	70	88	S.	S. W.	S. S. W.	11 17	5 28	3 92		Inapp.	" 10.	Snow.	Cu. Str. 8.
29	30 104	30 019	30 047	8 0	22 0	11 9	018	084	.060	77	71	80	N. E. by E.	N. E. by E.	N. E. by E.	8 36	1 30	2 03		0 50	C. Str. 8.	Cu. Str. 6.	Snow.
30	29 814	29 800	29 805	12 1	31 1	21 0	061	118	075	81	68	73	N. N. W.	E.	S. S. E.	10 61	0 57	0 00		...	" 10.	. ...	....

REMARKS FOR OCTOBER, 1859.

Barometer { Highest, the 12th day, 30·160 inches.
Lowest, " 27th " 29·251 "
Monthly Mean, 29·779 inches.
" Range, 0·909 "

Thermometer ... { Highest, the 5th day, 83°1.
Lowest, the 25th day, 19°4.
Monthly Mean, 42°42.
Monthly Range, 63°7.

Greatest intensity of the Sun's rays, 105°8.
Lowest point of terrestrial radiation, 14°2.
Mean of humidity, 754.
Amount of evaporation in inches, 1·27.
Rain fell on 6 days, amounting to 1.629 inches; it was raining 20 hou[illegible] 51 minutes, and was accompanied by thunder on 1 day.

Snow fell on 3 days, amounting to 2.30 inches; it was snowing 24 hours.
First snow of the season fell on the 20th day.
Most prevalent wind, the W. N. W.
Least prevalent wind, E.
Most windy day, the 19th day; mean miles per hour, 21.81.
Least windy day, the 17th day, mean miles per hour, 0·29.
Aurora Borealis visible on 4 nights.
Lunar Haloes " " 2 nights.
The Electrical state of the atmosphere has indicated high and constant tension.
Ozone was present in moderate quantity.

REMARKS FOR NOVEMBER, 1859.

Barometer. . . { Highest, the 7th day, 30·139 inches.
Lowest, " 13th " 29·180 "
Monthly Mean, 29·940 inches.
Monthly Range, 1·259 "

Thermometer. { Highest, the 18th day, 57°6.
Lowest, " 25th " 4°6.
Monthly Mean, 29°38.
Monthly Range, 43°0.

Greatest intensity of the Sun's rays, 96°7.
Lowest point of terrestrial radiation, 5°1.
Mean of humidity, 819.
Rain fell on 9 days, amounting to 7.822 inches; it was raining 73 hours 55 minutes.

Snow fell on 11 days, amounting to 15.73 inches; it was snowing 68 hours 20 minutes.
Most prevalent wind, N. E. by E.
Least prevalent wind, E.
Most windy day, the 3rd day: mean miles per hour, 23.06.
Least windy day, the 27th day; mean miles per hour, 1·72.
Aurora Borealis visible on — nights.
Snow Birds ("Plectrophanes nivalis,") first seen on 3d day.
Lunar Halo visible on 1 night.
The Electrical state of the atmosphere has indicated moderate intensity.
Ozone was present in large quantities.